California Regional Water Quality Control Board
Central Coast Region

Total Maximum Daily Loads for Nutrients (Nitrate, Unionized Ammonia and Biostimulatory Substances) in Santa Maria River and Oso Flaco Creek Watersheds, Santa Barbara and San Luis Obispo Counties, California

Phase Five: Regulatory Action Selection
Draft Project Report

September 9, 2008

Adopted by the
California Regional Water Quality Control Board
Central Coast Region
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on _______________, 200 x
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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
895 Aerovista Place, Suite 101, San Luis Obispo, California 93401
Phone • (805) 549-3147
http://www.waterboards.ca.gov/centralcoast/

STATE OF CALIFORNIA

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Vacant	Municipal Government

Roger Briggs, *Executive Officer*
Michael Thomas, *Assistant Executive Officer*

This report was prepared under the direction of
Lisa H. McCann *Environmental Programs Manager*
Angela Schroeter, *Senior Engineering Geologist*
Chris Rose, *Senior Environmental Scientist*

by
Katie McNeill, *Environmental Scientist*

with the assistance of
Mary Adams, *Environmental Scientist*
Larry Harlan, *Environmental Scientist*
David Innis, *Environmental Scientist*
Alison Jones, *Environmental Scientist*
Ryan Lodge, *Water Resource Control Engineer*
Sorrel Marks, *Water Resource Control Engineer*
Monica Barricarte, *Environmental Scientist*

and support and input provided by
Numerous stakeholders, including agencies, organizations, and individuals who have a special interest in the Santa Maria and Oso Flaco watersheds.

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LIST OF ACRONYMS AND ABBREVIATIONS

CEQA	California Environmental Quality Act
CCAMP	Central Coast Ambient Monitoring Program
GIS	Geographic Information System
HUA	Hydrologic Unit Area
IRWMP	Integrated Regional Watershed Management Plan
MEP	Maximum Extent Practicable
MRLC	Multi-Resolution Land Characterization
MS4s	Municipal Separate Storm Sewer Systems
MUN	Municipal and domestic water supply
NPDES	National Pollutant Discharge Elimination System
NH_3	Un-ionized ammonia
NH_{4+}	Ammonium
QAPP	Quality Assurance Project Plan
SBFCD	Santa Barbara Flood Control District
TMDLs	Total Maximum Daily Loads
USACE	United States Army Corps of Engineers
US EPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
Water Board	Central Coast Water Quality Control Board (Region 3)
WDR	Waste Discharge Requirements
WWTP	Waste Water Treatment Plant

1. PROJECT SCOPE

This report addresses nitrate impairment of Oso Flaco Lake, Oso Flaco Creek and its tributary, Little Oso Flaco Creek, and the Santa Maria River and its tributaries, Main Street Canal, Bradley Channel, Bradley Canyon Creek, and Orcutt-Solomon Creek. This report also addresses the Santa Maria Estuary as it is a downstream receiving waterbody of the Santa Maria River. Each of these water bodies, with the exception of Little Oso Flaco Creek, is specifically identified or proposed to be included on the 303(d) list as impaired due to nitrate.

In October 2006, Central Coast Water Quality Control Board (Water Board) staff concluded that the most efficient and effective way to address the proposed ammonia listings in 2006 was to incorporate them into the existing nitrate project. As such, this report also addresses the ammonia impairment of Oso Flaco Creek, the Santa Maria River and its tributaries, Main Street Canal, Blosser Channel, Bradley Channel, Bradley Canyon Creek, and Orcutt-Solomon Creek.

In February 2007, U.S. Fish and Wildlife Service (USFWS) staff raised concern for two rare and endangered fresh water wetland plants in Oso Flaco Lake. As a result of consultation with multiple agency staff, staff decided to expand the scope of this project to include protection of aquatic life from nutrient impacts. As such, this report addresses nitrogen and phosphate, in part, as potential stressors on healthy aquatic life. While TMDLs are not prescribed for specific nutrients, with the exception of nitrate levels protective of drinking water, staff recommends biomass criteria, which are influenced by nitrate and phosphate levels. As such, either nitrate or phosphate levels can be reduced to meet the predicted biomass criteria.

1.1. Project Planning and Vision Alignment

Staff considered this project to be high priority based on the severity of beneficial use impairment, the elevated levels of nutrients in both surface and groundwater within the project area, and the complexity of and need for new programs and reporting mechanisms for measurable progress towards water quality attainment in the project area.

Water Board staff aligned the schedule and scope of this project with the Vision of healthy watersheds. Water Board staff has identified three measurable goals as part of the Vision of healthy watersheds. This project aligns with all three of the Water Board's goals as follows:

Goal 1: By 2025 80% of Aquatic Habitat is healthy; and the remaining 20% exhibits positive trends in key parameters (by assessing nutrient levels and implementing strategies to support drinking water supply and aquatic life beneficial uses).

Goal 2: By 2025 80% of lands within any watershed will be managed to maintain proper watershed functions, and the remaining 20% will exhibit

positive trends in key watershed parameters (by evaluating existing regulatory programs and additional actions needed to correct the impairment).

Goal 3: By 2025, 80 %of groundwater will be clean, and the remaining 20 percent will exhibit positive trends in key parameters (by assessing degraded groundwater levels in the Santa Maria Valley and identifying levels and recommending corrective measures necessary to achieve water quality objectives)

Staff prepared this report in the context of existing implementation and monitoring efforts, some of which are regulatory requirements, which address the nutrient impairment. As part of this report, staff identified possible implementation actions, or alternatives that will further address controllable sources. Staff aligned the Implementation Plan with the Water Board's Vision. For example, the Implementation Plan includes nutrient management, and applying low impact development (LID) principles to urban development.

In 2007-08, Water Board staff collected an additional year of ambient water quality data in the project area. Staff continued to pursue this project despite delays in the project's schedule to expand the scope to include ammonia and aquatic life impairments, as well as to be able to incorporate additional nutrient data into the project analyses. Staff incorporated the additional data into the project report in March 2008 and plans to circulate this document for additional stakeholder review in 2008. Water Board staff will then submit that document for scientific peer review.

The State's Guidance for addressing impaired waters (Process for Addressing Impaired Waters in California, June 2005) describes and allows for 8 phases (Project Definition, Project Planning, Data Collection, Project Analyses, Regulatory Action Selection, Regulatory Process, Approval, and Implementation). This project is currently in Phase 5, Regulatory Action Selection. In Phase 5, Water Board staff pursued additional work identified previously, and incorporated California Environmental Quality Act (CEQA) and technical comments from stakeholders in this document.

This report represents the final deliverable for Phase 5 of the Process for Addressing Impaired Waters in California (June 2005). The information contained in this report will be used as the foundation for development of a Final Project Report, a deliverable in Phase 6 of the process, scheduled for completion in 2008.

Despite delays, staff anticipates completing all tasks and preparing all reports on time and within allocated resources according to the Water Board's TMDL Program Workplan for Fiscal Year 2008-2009, unless further evaluations require more effort than planned. Staff's approach to further investigations includes field surveys, and evaluating additional existing data and information.

This report presents available data, sources, TMDL components, and implementation plan.

2. WATERSHED DESCRIPTION

The Santa Maria and Oso Flaco watersheds are located in Northwestern Santa Barbara County and Southwestern San Luis Obispo County, California. The watersheds are about 50 miles north of Point Conception and about 150 miles south of Monterey Bay on the central California coast. The climate is mild with 14 inches average rainfall a year.

The area is a broad alluvial plain near the ocean, tapering gradually inland. Upland or mesa areas, foothills, and mountain complexes further define the alluvial plain boundary.

The following information was taken from the Final Hydrologic Unit Area (HUA) Report (CCAMP 2006):

> The Santa Maria River Hydrologic Unit includes all areas tributary to the Cuyama River, Sisquoc River, and Santa Maria River. At 1,880 square miles (1.2 million acres) the Santa Maria River watershed is one of the larger coastal drainage basins of California. The Cuyama River and Sisquoc River originate in wilderness areas of the Los Padres National Forest. The Santa Maria River is formed by the confluence of the Cuyama and Sisquoc approximately 7 miles southwest of Santa Maria. The Sisquoc River and Upper Cuyama (above Sierra Madre Road) are in a reasonably natural state with much of the watershed located in National Forest. Within the Los Padres Forest Service boundary, the upper 33 miles of the Sisquoc is listed as a National Wild and Scenic River.
>
> Below Sierra Madre Road the channel of the Cuyama has been highly altered to better align with State Highway 166. Much of the upper Cuyama watershed is made up of sedimentary marine deposits that are naturally erosive. As a result, the river carries a heavy sediment load. The Twitchell reservoir (completed in 1958) is located on the Cuyama River six miles above the confluence with the Sisquoc River. The dam traps much of the sediment contained in the Cuyama flows.
>
> The Santa Maria valley is a broad flat valley, protected from flooding by levees and a series of flood control channels and basins. The lower Santa Maria River Watershed, including the Santa Maria River, is highly altered. The river has a very sandy, braided channel and is leveed along much of its length. It is a "losing" stream, meaning that surface water flow tends to rapidly infiltrate into underlying permeable layers. The river is the major source of recharge to the Santa Maria groundwater basin. Urban runoff and associated pollutants also tend to infiltrate, rather than flow to the Santa Maria River.
>
> Nipomo Creek drains the Nipomo Valley and joins the Santa Maria River just west of US Highway 101. Solomon (Orcutt) Creek drains the Orcutt area and joins the Santa Maria River near its outlet to the Pacific Ocean. Oso Flaco Lake and its drainage, though not part of the Santa Maria watershed, are included in Hydrologic Unit 312. Oso Flaco Lake is north of the Santa Maria Estuary.
>
> Major activities in the Santa Maria watershed include irrigated and dryland agriculture, oil production, and urban development. Twitchell Reservoir serves important flood control and water recharge functions. Sedimentation of this

> reservoir is reducing its water storage capacity, and if allowed to continue will affect the reservoir's flood control capacity. Pollutants of known concern in the watershed prior to this assessment include nitrates and total dissolved solids in groundwater, organochlorine pesticides in the estuary, and petroleum production byproduct (diluent) in groundwater and surface water of the Guadalupe Dunes and nearby areas. Several waterbodies in this Hydrologic Unit are now listed on the CWA section 303(d) list of impaired waterbodies (CCRWQCB 2006). Prior to CCAMP monitoring, very little data was available for the Santa Maria Hydrologic Unit and no streams or river segments were included on the 303(d) list.

The Santa Maria Valley groundwater basin extends south from the Nipomo Mesa to the Orcutt Uplands. Coarse-grained alluvial channel deposits in the river grade to finer silt and clay floodplain deposits as distance from the Santa Maria River channel increases.

While a portion of the area's water resource is imported, the groundwater system provides the majority of the supply, and is closely related to the impairments.

According to the Development of a Numerical Groundwater Flow Model and Assessment of Groundwater Basin Yield for the Santa Maria Valley Groundwater Basin (Luhdorff and Scalmanini, 2000), the groundwater system in the project area was strongly influenced by stream flow in the Sisquoc, Cuyama, and Santa Maria Rivers, and by Orcutt Creek, all which typically acted as sources of recharge to the aquifer. Discharge from the aquifer, characterizing gaining stream conditions, historically occurred to a limited extent near the Santa Maria River Estuary. While the streams in the project area were primarily losing streams, gaining or losing stream conditions were determined by the hydraulic gradient between the rivers and creeks and the groundwater system, which changed due to factors such as precipitation and surface water releases from Twitchell Reservoir.

Water Board staff found that groundwater nitrate concentrations in portions of Santa Maria River and other subwatersheds were substantially elevated above suspected background concentrations, with numerous sites consistently exceeding the water quality objective. Irrigated agricultural growers often irrigate with groundwater that has elevated nitrate levels. The origins (e.g. fertilizer, sewage, dairies) of the elevated nitrate levels throughout the project area are somewhat uncertain. Furthermore, the impacts of the degraded groundwater to the listed water bodies were not fully understood at the time of writing of this report.

The land uses in the Santa Maria and the Oso Flaco watersheds (the Project Area) are a mosaic of open space including rangeland, irrigated agriculture, and urban areas.

The major watersheds in the Project Area are shown in Figure 1.

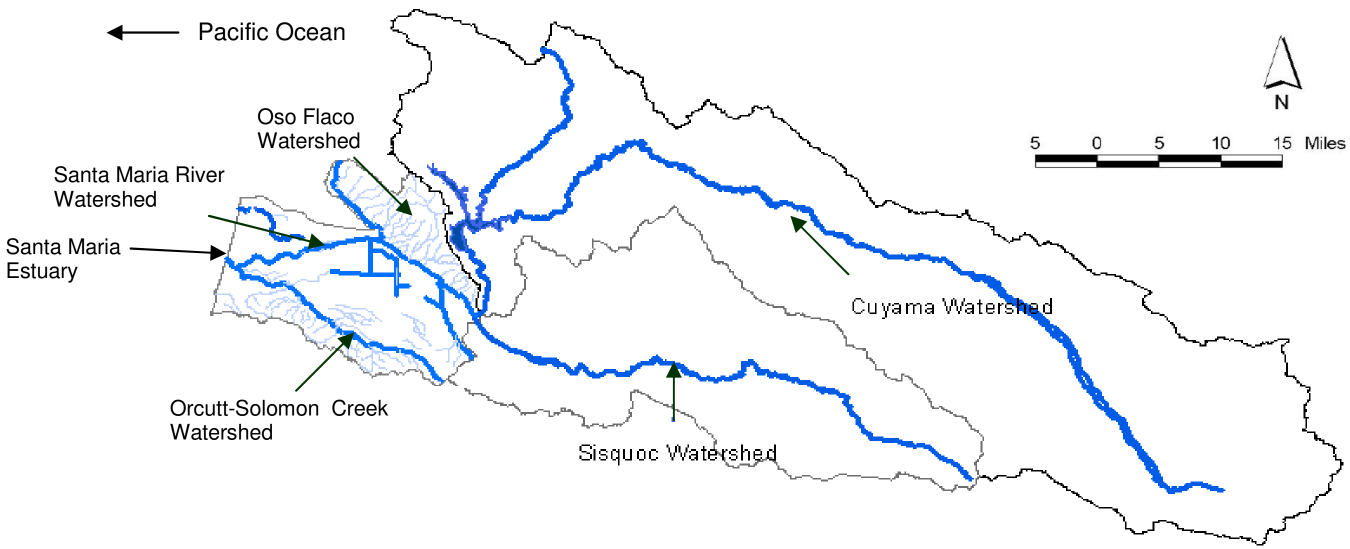

Figure 1. Major Watersheds and Waterbodies in the Project Area.

2.1. Beneficial Uses

The Water Board is responsible for protecting water resources from pollution and nuisance that may occur as a result of waste discharges. The Water Board determines beneficial uses that need protection and adopts water quality objectives that are necessary to protect the beneficial uses in the *Water Quality Control Plan* (Basin Plan).

The beneficial uses associated with drinking water, aquatic life, and irrigation water for sensitive crops are the principal water quality considerations with respect to nitrate. Elevated levels of nitrate are unsafe for municipal and drinking water supply (MUN) uses. Elevated levels of un-ionized ammonia also impair numerous beneficial uses (biostimulatory and toxicity to aquatic life and habitat).

The Basin Plan specifically identifies beneficial uses for some of the listed water bodies included in this analysis. The Santa Maria River, Orcutt Creek, and Oso Flaco Creek and Lake have designated beneficial uses in the Basin Plan. The beneficial uses cited in the Basin Plan are listed in Table 1. Water Board staff interpreted Orcutt Creek as being synonymous with Orcutt-Solomon Creek.

The Basin Plan states surface water bodies within the Region that do not have beneficial uses designated for them are assigned the beneficial uses of “municipal and domestic water supply” and “protection of both recreation and aquatic life.” Water Board staff interpreted this general statement of beneficial uses to encompass the specific beneficial uses of water contact and non-contact recreation, municipal and domestic supply, and warm fresh water habitat. Main Street Canal, Blosser and Bradley Channels, Bradley Canyon Creek, and Little Oso Flaco Creek are not specifically listed in the Basin Plan and therefore are designated with those beneficial uses.

As mentioned above, beneficial uses are specifically identified for Oso Flaco Lake in the Basin Plan however, municipal and domestic supply is not one of its designated uses. As such, Water Board staff did not recommend nitrate TMDLs for Oso Flaco Lake. While staff did not assign nitrate TMDLs for Oso Flaco Lake, staff recommended nutrient TMDLs protective of aquatic habitat, which are influenced by nitrate and phosphate levels. As such, either nitrate or phosphate levels can be reduced to meet the predicted biomass criteria in Oso Flaco Lake. Furthermore, in the creeks that drain to the lake, staff proposed nitrate TMDLs protective of municipal and domestic supply beneficial uses as well as nutrient TMDLs protective of aquatic life beneficial uses.

Table 1. Designated Beneficial Uses for Santa Maria River and Oso Flaco Water Bodies from the Basin Plan.

Water body	Santa Maria River	Orcutt Creek	Oso Flaco Creek	Oso Flaco Lake
Municipal and Domestic Supply (MUN).	X	X	X	
Agricultural Supply (AGR)	X	X	X	
Industrial Process Supply (PROC)				
Industrial Service Supply (IND)	X			
Ground Water Recharge (GWR)	X	X	X	X
Water Contact Recreation (REC-1)	X	X	X	X
Non-Contact Water Recreation (REC-2)	X	X	X	X
Wildlife Habitat (WILD)	X	X	X	X
Cold Fresh Water Habitat (COLD)	X	X		
Warm Fresh Water Habitat (WARM)	X		X	X
Migration of Aquatic Organisms (MIGR)	X			
Spawning, Reproduction, and/or Early Development (SPWN)				X
Preservation of Biological Habitats of Special Significance (BIOL)			X	X
Rare, Threatened, or Endangered Species (RARE)	X	X	X	X
Estuarine Habitat (EST)		X		
Freshwater Replenishment (FRSH)	X	X	X	
Navigation (NAV)				X
Hydropower Generation (POW)				
Commercial and Sport Fishing (COMM)	X	X	X	X
Aquaculture (AQUA)				
Inland Saline Water Habitat (SAL)				
Shellfish Harvesting (SHELL)				

2.2. Water Quality Objectives

The water quality objectives in the Basin Plan that directly apply to the TMDLs are as follows:

- The municipal drinking water supply beneficial use is protected by the numeric water quality objective of 10 mg/L maximum for nitrate (as N).
- The general water quality objective for toxicity includes a maximum concentration of 0.025 mg/L for un-ionized ammonia (NH_3).
- A general narrative water quality objective states that: “Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.”

Nitrate levels suitable for municipal drinking water supply may still also be harmful to aquatic life. As such, Water Board staff evaluated the appropriateness of including a numeric criterion for biostimulatory substances. Water Board staff also evaluated the influence of nutrients present in groundwater on surface water nutrient concentrations.

2.3. Waste Discharge Prohibitions

The Water Board can prohibit specific types of discharges to certain areas (California Porter-Cologne Water Quality Control Act Section 13243). These discharge prohibitions may be revised, rescinded, or adopted as necessary. Discharge prohibitions are described in pertinent sections of Chapter 4, "Implementation Plan" and Chapter 5, "Plans and Policies" in the Regional Board Discharge Prohibition Section (Basin Plan).

The following information is contained in the Basin Plan, and relates to the TMDLs:

Waste discharges to the following inland waters are prohibited: Santa Maria River downstream from the Highway One bridge.

Waste discharged to ground waters shall be free of toxic substances in excess of accepted drinking water standards; taste, odor, or color producing substances; and nitrogenous compounds in quantities which could results in a ground water nitrate concentration above 45 mg/L (or 10 mg/L-N)

2.4. Problem Statement

Oso Flaco Creek, the Santa Maria River and listed tributaries and drainages are identified on the 2006 Clean Water Act (CWA) Section 303(d) List of Water Quality Limited Segments (the 303(d) list) because nitrate levels exceeded the municipal drinking water supply water quality objective and un-ionized ammonia levels exceeded the toxicity water quality objective. Water Board staff evaluated impacts to the more sensitive beneficial uses (e.g. aquatic life) and determined that nutrient levels (nitrate) lower than the municipal drinking water supply water quality objective are necessary to protect all beneficial uses. As such, staff proposes numeric targets that will be protective of the municipal drinking water supply and aquatic life-related beneficial uses.

Water Board staff previously used water quality data collected by the Central Coast Ambient Monitoring Program (CCAMP) to recommend inclusion on the 303(d) list. The results of CCAMP data collection, along with additional data collected in these watersheds, are discussed in Section 4 Data Analysis. Table 2 shows water bodies identified as impaired on the 303(d) list as well as those impaired by nitrate, unionized ammonia, and nutrients. Water Board staff proposes TMDLs be developed for the water bodies as shown. These TMDLs will be protective of 1) municipal and domestic water supply beneficial uses for those impaired by nitrate, 2) general water quality objective for toxicity for those impaired by unionized ammonia, and 3) aquatic life beneficial uses for those impaired by nutrients.

Table 2. Water bodies identified as impaired on the 303(d) List and Impairment.

	Listing Status and Impairment by Pollutant		
Water body	Listed for Nitrate? Impaired by Nitrate?	Listed for Un-ionized Ammonia? Impaired by Un-ionized Ammonia?	Listed for Nutrients? Impaired by Nutrients?
Bradley Canyon Creek	Yes Yes	Yes Yes	No Yes
Bradley Channel	Yes Yes	No Yes	No Yes
Blosser Channel	No No	No Yes	No Yes
Main Street Canal	Yes Yes	Yes Yes	No Yes
Santa Maria River	Yes Yes	Yes Yes	No Yes
Santa Maria Estuary	No Yes	No Yes	No Yes
Orcutt (Solomon) Creek	Yes Yes	Yes Yes	No Yes
Oso Flaco Creek	Yes Yes	Yes Yes	No Yes
Little Oso Flaco Creek	No Yes	No No	No Yes
Oso Flaco Lake	Yes No	No No	No Yes

3. NUMERIC TARGETS

The municipal drinking water supply beneficial use is protected by the numeric water quality objective of 10 mg/L-N maximum for nitrate. The general water quality objective for toxicity includes a maximum concentration of 0.025 mg/L for un-ionized ammonia (NH_3-N). The proposed numeric targets for this project are consistent with these water quality objectives.

Water Board staff also evaluated impacts to the more sensitive beneficial uses (e.g. biostimulatory effects, toxicity to aquatic life) and included methodologies for determining multi-parameter numeric targets protective of aquatic life. There are no numeric objectives that protect from toxic nitrate levels and staff was unable to determine specific numeric values. At the time of writing, there was also not sufficient evidence that nitrate toxicity was occurring in the Project Area. As such, staff proposes only an ammonia toxicity target consistent with the Basin Plan to protect aquatic life from toxicity.

There are also no numeric objectives that protect surface waters from the biostimulatory effects of excessive nutrients. Biostimulation can result from a complex interaction of several nutrients, sunlight, stream substrate, water velocity, and other factors. It is, therefore, difficult to quantify numeric targets applicable across varied field conditions that would prevent biostimulation. It is difficult to identify specific nitrate or phosphate concentrations that represent thresholds over which problems will certainly occur. Consequently, the Central Coast Basin Plan describes a narrative water quality objective for biostimulatory substances applicable to all waters in the Central Coast Region. The narrative objective is interpreted and applied on a case-by-case, site-by-site scenario. The narrative objective is as follows:

> "Waters shall not contain bio-stimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses."

Staff sought to develop numeric targets protective of this narrative objective. To this effort, staff reviewed other TMDLs with similar beneficial uses, land uses, and topography. For the Malibu Creek TMDL, the numeric targets were 1.0 mg/l-N for total nitrogen and 0.1 mg/l-N as a target for total phosphorus for the summer period. These values are consistent with EPA coastal values (NOAA/EPA 1998) and similar to the values for the eutrophic/mesotrophy proposed by Dodds et al. in 2000 (1.5 mg/l-N TN and 0.075 mg/l-_ TP). Staff used these nutrient values as comparisons to values developed for this TMDL.

Staff used the following approaches to develop nutrient targets and compared the resulting values to targets used in the Malibu Creek TMDL and other literature values. .

- Nutrient Numeric Endpoints (NNE)
- Biostimulatory Risk Index

These approaches are discussed below.

3.1. Nutrient Numeric Endpoints (NNE)

Tetra Tech, Inc., under contract to EPA Region 9 and the California State Water Resources Control Board, developed an approach for calculating nutrient numeric endpoints (NNE) for use in California Water Quality Programs (Tetra Tech, 2006). One important use of the NNE was for setting initial nutrient endpoints for waterbodies requiring nutrient TMDLs that address impairments associated with benthic algae. Tetra Tech (2006) developed a set of user-friendly spreadsheet tools to assist in evaluating the relationship between in-stream nutrient concentrations and solar radiation, and the predicted benthic algal biomass.

The California NNE approach is a risk-based approach, with ultimate focus on supporting designated uses. The general NNE guidance and accompanying tools provided initial, scoping-level estimates of nutrient reduction targets to be used as a *starting* point for a TMDL or nutrient management plan. More sophisticated site-specific nutrient targets can be derived from the response targets through the use of calibrated, site-specific models. Calibration of the benthic algal component of such a model would require collection of data on periphyton densities in each waterbody.

The California NNE Approach (Tetra Tech, 2006) recommended setting response targets for benthic algal biomass in streams based on maximum density expressed as mg/m^2 chlorophyll *a*. For the COLD beneficial uses, the recommended Beneficial Use Risk-Category for presumably unimpaired and potentially impaired (BURC I/II) upper boundary was 100 mg/m^2, while the Beneficial Use Risk-Category for presumably impaired (BURC II/III) upper boundary was 150 mg/m^2.

The criteria for Benthic Algal Biomass recommended by USEPA is as follows:

COLD – 150 mg/m^2
WARM – 200 mg/m^2

The following combination of total nitrogen or total phosphorus and aerial cover over the stream (e.g. riparian vegetation), will achieve the COLD and WARM algal biomass criteria recommended by USEPA.

Nitrogen (total inorganic N)	1.0 mg/L – 0% cover 3.0 mg/L – 80% cover
Phosphorus (total inorganic P)	From Redfield ratio: 0.14 mg/L – 0% cover 0.42 mg/L – 80% cover

Development of quantitative nutrient targets based on benthic algal response should include the collection of appropriate data on existing benthic algal density to allow examination and calibration of model predictions. Staff recommends collecting benthic algal density data in the Monitoring Plan.

Staff used the NNE Benthic Biomass Predictor spreadsheet tool to determine whether the response targets could be translated into feasible nutrient concentration goals. The model results suggested that reductions in existing nutrient concentrations are necessary to meet response targets of algal biomass.

Staff applied the NNE tool to the Santa Maria River and Oso Flaco Creek and results suggested the need for lowering existing nutrient concentrations to support uses based on benthic algal response. At the same time, efforts to improve riparian cover will limit light availability and decrease algal response – essentially increasing the assimilative capacity of the creek for nutrients.

Water Board staff inputted existing nutrient data (2000-01) from the Project Area into the NNE modeling tool using the Revised QUAL2K, benthic chlorophyll-a method (Tetra Tech, 2006), and found that with 20% nor 80% canopy closure, existing nutrient conditions did not meet benthic algal biomass (chlorophyll-a) criteria. These values are shown in bold in Table 3.

Staff then inputted existing and hypothetical nutrient data with 20% and 80% canopy cover needed to meet recommended criteria for Oso Flaco Creek and the Santa Maria River. Per the designated beneficial uses in the Basin Plan (Table 1), staff applied the COLD benthic chlorophyll-a criteria to the Santa Maria River and the WARM criteria to Oso Flaco Creek. The results of staff's model applications are shown in Table 3. As shown, model applications for the Santa Maria River at a monitoring site located on the

Santa Maria River at Highway 1 (312SMI) using the COLD criteria, existing nitrate levels or maximum nitrate levels of 10 mg/L with lower than existing average phosphate levels (0.01 mg/L and 0.02 mg/L) resulted in predicted benthic algal biomass conditions with 20% cover of 145 mg/m^2 and with 80% cover of 134 mg/m^2 respectively. As part of staff's model applications for Oso Flaco Creek (at a monitoring site located on Oso Flaco Creek at Oso Flaco Lake Road (312OFC) using the WARM criteria, existing average nitrate levels or maximum nitrate levels of 10 mg/L with lower average phosphate levels (0.018 mg/L with 20% cover and 0.04 mg/L with 80% cover) resulted in predicted benthic algal biomass conditions of 199 mg/m^2 and 194 mg/m^2 respectively.

Staff found that reductions in either nitrate or phosphate resulted in benthic algal biomass conditions within recommended levels of 150 mg chl-*a*/m^2 for waterbodies supporting COLD beneficial uses and 200 mg chl-*a*/m^2 for waterbodies supporting WARM beneficial uses. Staff also found that increasing canopy cover from 20% to 80% allowed for slightly higher nutrient levels.

Table 3. Existing and anticipated nitrate and phosphate concentrations with 20% and 80% canopy cover and predicted benthic algal biomass (mg/m^2).

	Canopy Cover (%)	Average Nitrate (mg/L as N)	Average Phosphate (mg/L as P)	Predicted Benthic Algal Biomass (mg/m^2)
Santa Maria River	**20%**	**30**	**0.5**	**568**
Santa Maria River	**80%**	**30**	**0.5**	**359**
Santa Maria River	20%	10	0.01	145
Santa Maria River	80%	10	0.02	134
Santa Maria River	20%	0.4	0.5	146
Santa Maria River	80%	1.3	0.5	147
Oso Flaco Creek	**20%**	**37**	**0.4**	**566**
Oso Flaco Creek	**80%**	**37**	**0.4**	**357**
Oso Flaco Creek	20%	10	0.018	194
Oso Flaco Creek	80%	10	0.04	199
Oso Flaco Creek	20%	0.4	0.4	199
Oso Flaco Creek	80%	2.7	0.4	200

Values in bold = existing (2000-01) nutrient concentrations not protective of aquatic life

Model results indicated that either nitrate or phosphate levels could be reduced to meet the WARM and COLD biomass criteria. As such, staff determined that various nutrient levels and canopy coverage could be combined to protect beneficial uses. Reducing phosphate contributions allowed nitrate contributions to be higher, while protecting both the drinking water beneficial use and those for aquatic life. Moreover, specific nutrient values (other than those protective of the municipal and domestic supply of 10 mg/L nitrate as N) did not need to be established as numeric targets ,as the environmental response targets quantified as biomass conditions, are established to protect the aquatic life beneficial uses.

Staff evaluated data for Oso Flaco Creek rather than for Oso Flaco Lake as the NNE tool was developed for use on creeks. Staff considered the protection of Oso Flaco Lake as it is a downstream receiving water to Oso Flaco Creek. While responses in the lake likely depend more on net annual loading of nutrients than on concentrations in the creek, achieving full support of uses in the lake may require further reductions in nutrient concentrations in the creek. This will be evaluated as part of the Monitoring Plan, as methodologies are developed for lake environments.

3.2. Biostimulatory Risk Index

The Water Board's CCAMP developed a "Biostimulatory Risk Index" to serve as a screening tool to evaluate sites for risk of problems associated with eutrophication. The Biostimulatory Risk Index simultaneously considers factors which serve as stimuli (nutrient concentrations), in parallel with those which act as responders (pH, dissolved oxygen, algal and plant cover, water column chlorophyll concentrations). The index was intended to characterize both in-situ monitoring site response to biostimulatory substances and the capacity of monitoring site water quality parameters to induce adverse biostimulatory responses in downstream areas. The index currently has no provision for addressing nutrient-poor waters, nor waters impacted by toxic effects associated with several of the index components.

The Biostimulatory Risk Index is a combination of several different measures, or "metrics" of stimuli or response, which have been percentile ranked and combined to form a single value. CCAMP collected data on a number of parameters that served as measures of biostimulation or response. Some of these measures, such as nutrient or chlorophyll concentrations, serve as metrics based on magnitude alone (where higher concentrations are considered "worse" than lower concentrations and are ranked accordingly). Others are more complex, particularly "double-ended" parameters such as dissolved oxygen and pH. For example, both supersaturated and depressed concentrations of dissolved oxygen can be indicative of eutrophication. For such parameters the departure of the measurement from the Regional median value is used to calculate the metric (where a larger departure ranks worse than a smaller departure). Various forms of plant cover are stimulated by nutrients and can create nuisance conditions. The Index utilizes the maximum value from three qualitative estimates of percent cover for rooted plants, filamentous algae and periphyton, to calculate a plant cover metric.

CCAMP staff evaluated performance of the index using data from the entire Region. Weighting factors for each metric were initially determined by confining the database under consideration to several Hydrologic Units well known to staff, and setting weighting factors to values that ranked sites in a sequence that was consistent with staff knowledge of the sites. Performance of the index was then examined in other Hydrologic Units not used to develop the weighting factors, using different staff, knowledgeable of site and waterbody characteristics in the new set of Hydrologic Units. Through iterative adjustment of weighting factors, index performance was tested until all staff agreed that site rankings best reflected overall staff knowledge of site conditions.

Staff evaluated the final site ranking for evidence of threshold values at which sites begin to show overall impairment or cause downstream problems. Staff agreed that above an average index score of 0.40, sites begin to commonly show signs of impairment, including algal blooms, widely ranging dissolved oxygen concentrations, and elevated nutrient concentrations. Staff recommended using this value as a threshold for screening monitoring data for biostimulatory risk. Staff found that sites whose score falls below the threshold of 0.40 virtually never exceed the drinking water standard for nitrate. In fact, 89% of these had site nitrate averages under 1.0 mg/L-N. In contrast, sites with a risk score of 0.40 or greater never have healthy macroinvertebrate assemblages, those with benthic invertebrate community index scores in the highest quartile (over 0.60). Waterbody specific Biostimulatory Risk Index scores are discussed in the Section 4.1.

Staff compared results of the NNE model applications and Biostimulatory Risk Index scores at Cuyama River at a monitoring site on the Cuyama River downstream of Buckhorn Road at (312CUY); and at Sisquoc River at a monitoring site on the Sisquoc River at Santa Maria Way (312SIS) along with impaired sites in the Project Area.

Predicted benthic chlorophyll-a levels were within recommended criteria at sites where Biostimulatory Risk Index scores were less than 0.4. This information suggests that the two methodologies produce similar assessment results. Staff recommends that the results be compared as part of each three year review.

Staff did not find any methodologies that quantitatively predict healthy freshwater wetland plant habitat based on nutrient contributions. As such, staff recommends performing habitat assessments that include both benthic algae and sensitive freshwater wetland plants during implementation to measure progress towards achieving healthy aquatic habitat.

3.3. Numeric Targets Summary

Staff proposes four numeric targets to protect the beneficial uses in the project area. These are as follows:

1) The municipal and domestic supply beneficial use is protected by the numeric water quality objective of 10 mg/L-N maximum for nitrate.

2) The general water quality objective for toxicity includes a maximum concentration of 0.025 mg/L for un-ionized ammonia (NH_3-N).

3) Aquatic life is protected by a maximum Benthic Algal Biomass of 150 mg chl-*a*/m^2 for waterbodies supporting COLD beneficial uses and 200 mg chl-*a*/m^2 for waterbodies supporting WARM beneficial uses.

4) Aquatic life is protected by a maximum Biostimulatory Risk Index score of 0.40.

4. DATA ANALYSIS

4.1. Water Quality Data Analysis

Water Board staff relied on data collected by the following entities or programs in preparing this report:

4.1.1. Central Coast Ambient Monitoring Program (CCAMP)
4.1.2. City of Santa Maria Stormwater
4.1.3. Orcutt-Solomon Creek Storm Event Monitoring
4.1.4. Oso Flaco Nitrate Study
4.1.5. Santa Maria Estuary Enhancement and Management Plan
4.1.6. Case Study: Rangeland Management Measure Implementation Monitoring
4.1.7. Wastewater Treatment Plant Monitoring
4.1.8. Santa Maria Sanitary Landfill
4.1.9. Santa Maria Valley Groundwater Basin Data
4.1.10. Department of Public Health Groundwater Data
4.1.11. Santa Maria Basin Oil Field Assessment
4.1.12. Santa Maria Oil Refinery

4.1.13. Black Lake Canyon Field Survey
4.1.14. Agricultural groundwater and field runoff monitoring
4.1.15. Conditional Agricultural Waiver Program's Cooperative Monitoring Program
4.1.16. Nutrient data comparison to aquatic life criteria

The following discussion summarizes the water quality monitoring activities and results, along with preliminary conclusions regarding sources. Water Board staff also evaluated flow data collected as part of many of these and other efforts; the results are discussed in Section 4.2 Flow Data. Results of a land use analysis are discussed in 4.3 Land Use Data.

4.1.1. Central Coast Ambient Monitoring Program

The Water Board's Central Coast Ambient Monitoring Program (CCAMP) conducted monthly nitrate and total ammonia monitoring in 2000 and 2001. Monthly water quality monitoring continued at the Santa Maria River site at Rancho Guadalupe Dunes Preserve through March 2003 and January 2004 - present. Water Board's CCAMP staff collected additional data in 2007-08 at all sites in the Santa Maria and Oso Flaco watersheds. Staff reviewed preliminary data collected by CCAMP. Notable results that either validate or differ from the 2000-01 data are included below. CCAMP staff calculated values of un-ionized ammonia from total ammonia laboratory results and field measurements of pH and temperature. These are shown in Appendix A.

Figure 2 and Figure 3 show the major water bodies and monitoring stations of the upper and lower Santa Maria and Oso Flaco watersheds, respectively. Little Oso Flaco Creek (shown but not identified in Figure 3) drains to Oso Flaco Creek from the East. Main Street Canal, Bradley Channel, Blosser Channel, and Bradley Canyon Creek (also not identified in Figure 3) flow into the Santa Maria River from the south.
Table 4 shows the names of the sampling sites.

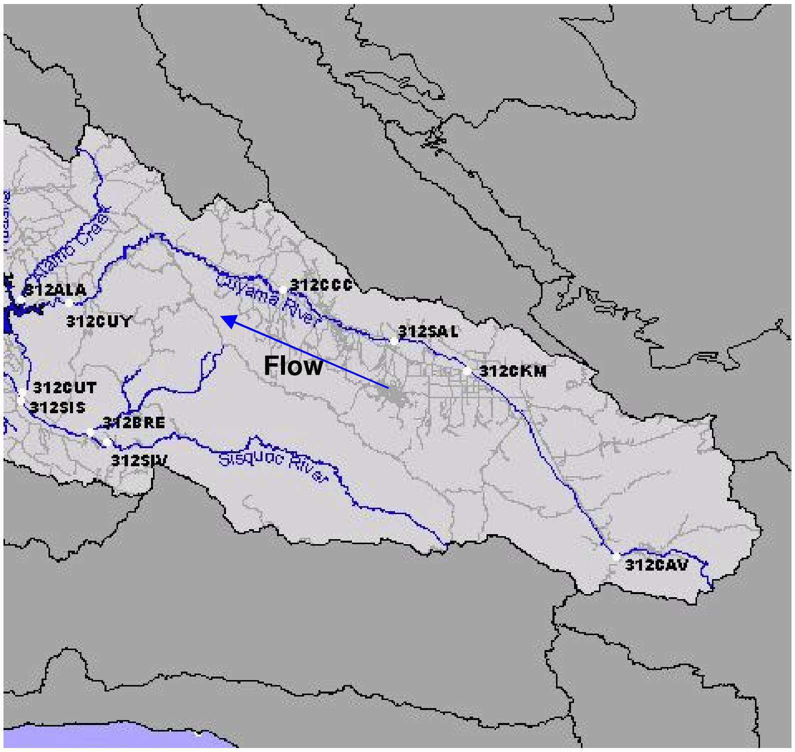

Figure 2. Major Water Bodies and CCAMP Monitoring Locations in the Upper Santa Maria Watershed.

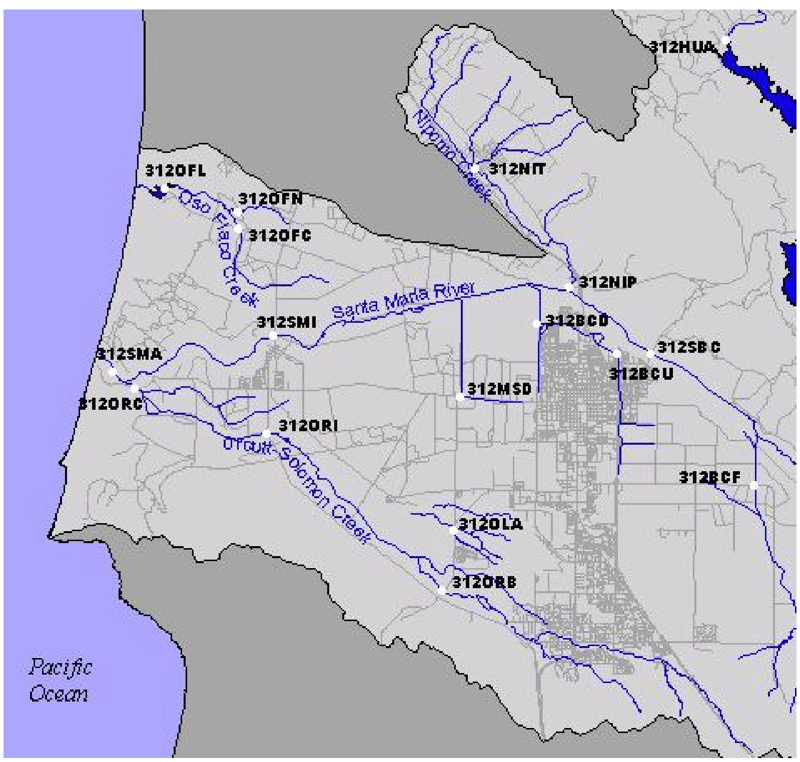

Figure 3. Major Water Bodies and CCAMP Monitoring Locations in the Lower Santa Maria Watershed and in the Oso Flaco Watershed.

Table 4. CCAMP Monitoring Locations in the Santa Maria And Oso Flaco Watersheds.

Water body	Site name	Site location
Alamo Creek	312ALA	312ALA-Alamo Creek at Alamo Creek Road
Blosser Channel	312BCD	312BCD-Blosser Channel d/s of groundwater recharge ponds
Bradley Canyon Creek	312BCF	312BCF-Bradley Canyon diversion channel @ Foxen Canyon Road
Bradley Channel	312BCU	312BCU-Bradley Channel u/s of ponds @ Magellan Drive
LaBrea Creek	312BRE	312BRE-LaBrea Creek u/s Sisquoc River
Cuyama River (above res.)	312CAV	312CAV-Cuyama River @ Highway 33
Cuyama River (above res.)	312CCC	312CCC-Cuyama River d/s Cottonwood Canyon
Cuyama River (above res.)	312CUL	312CUL-Cuyama River above Lockwood turnoff
Cuyama River (below res.)	312CUT	312CUT-Cuyama River below Twitchell @ White Rock Lane
Cuyama River (above res.)	312CUY	312CUY-Cuyama River d/s Buckhorn Road
Huasna River	312HUA	312HUA-Husana River @ Huasna Townsite Road
Main Street Canal	312MSD	312MSD-Main Street Canal u/s Ray Road @ Highway 166
Nipomo Creek	312NIP	312NIP-Nipomo Creek @ Highway 166
Nipomo Creek	312NIT	312NIT-Nipomo Creek @ Tefft Street
Oso Flaco Creek	312OFC	312OFC-Oso Flaco Creek @ Oso Flaco Lake Road
Oso Flaco Lake	312OFL	312OFL-Oso Flaco Lake @ culvert
Little Oso Flaco Creek	312OFN	312OFN-Little Oso Flaco Creek
Betteravia Lakes	312OLA	312OLA-Betteravia Lakes at Black Road
Orcutt Solomon Creek	312ORB	312ORB-Orcutt Solomon Creek @ Black Road
Orcutt Solomon Creek	312ORC	312ORC-Orcutt Solomon Creek u/s Santa Maria River
Orcutt Solomon Creek	312ORI	312ORI-Orcutt Solomon Creek @ Highway 1
Salisbury Creek	312SAL	312SAL-Salisbury Creek @ Branch Canyon Wash
Santa Maria River	312SBC	312SBC-Santa Maria River @ Bull Canyon Road
Sisquoc River	312SIS	312SIS-Sisquoc River @ Santa Maria Way
Sisquoc River	312SIV	312SIV-Sisquoc River u/s Tepusquet Road
Santa Maria River	312SMA	312SMA-Santa Maria River @ Rancho Guadalupe Dunes Preserve
Santa Maria River	312SMI	312SMI-Santa Maria River @ Highway 1

CCAMP staff also collected data at 312GVS (Green Valley Road) and 312MSS (Main Street South) in 2006-07.

Water Board staff evaluated water quality data collected in 2000-01 and in 2007-08 by CCAMP to evaluate seasonality and trends, and determine where water quality objectives were exceeded. Table 5. Table 6, and Table 7. display listing date and status, average, minimum, maximum, number of samples, and percent exceedances of the established nitrate municipal and domestic supply and ammonia general toxicity water quality objectives at water quality monitoring sites.

Table 5. Nitrate Concentrations in Water Bodies in the Santa Maria and Oso Flaco Creek Watersheds in 2000-01 and 2007.

		Nitrate/Nitrite as N (mg/L)					
		Listing Date	Ave	Min	Max	Count	% Exceedance of 10 mg/L NO_3-N
Blosser Channel	312BCD	Not Impaired	4.58	-0.01	12.40	19	11%
Bradley Canyon Creek	312BCF	2006	15.84	1.40	45.40	9	67%
Bradley Channel	312BCU	2006	11.55	0.32	33.00	24	38%
Little Oso Flaco Creek	312OFN	2002 (with Oso Flaco Creek)	34.92	24.40	54.00	32	100%
Main Street Canal	312MSD, 312MSS	2002	16.98	-0.01	67.00	37	57%
Orcutt (Solomon) Creek	312ORI, 312ORC	2002	35.89	9.82	69.00	51	98%
Oso Flaco Creek	312OFC	2002	36.87	23.00	70.20	21	100%
Oso Flaco Lake	312OFL	2002	30.51	22.00	37.10	25	100%
Santa Maria River	312SMA, 312SMI	2002	26.04	12.90	51.40	84	100%

Table 6. Unionized Ammonia Concentrations in Water Bodies in the Santa Maria and Oso Flaco Creek Watersheds in 2000-01 and 2007.

		Ammonia as N (mg/L)					
		Listing Status	Ave	Min	Max	Count	% Exceedance of 0.025 mg/L NH_3-N
Blosser Channel	312BCD	Proposed 2008	0.04	-0.03	0.19	19	37%
Bradley Canyon Creek	312BCF	2006	0.18	0.00	1.20	8	33%
Bradley Channel	312BCU	Proposed 2008	0.03	-0.01	0.36	23	33%
Little Oso Flaco Creek	312OFN	Not Impaired	0.00	0.00	0.01	19	0%
Main Street Canal	312MSD, 312MSS	2006	0.48	0.00	4.54	28	75%
Orcutt (Solomon) Creek	312ORI, 312ORC,	2006	0.03	0.00	0.31	43	19%
Oso Flaco Creek	312OFC	2006	0.23	0.00	2.12	19	53%
Oso Flaco Lake	312OFL	Not Impaired	0.00	0.00	0.01	21	0%
Santa Maria River	312SMA, 312SMI	2006	0.01	0.00	0.22	74	7%

Table 7. Phosphate Concentrations in Water Bodies in the Santa Maria and Oso Flaco Creek Watersheds in 2000-01 and 2007.

		Orthophosphate as P (mg/L)					
		Listing Status	Ave	Min	Max	Count	% Exceedance
Blosser Channel	312BCD	N/A	0.30	0.11	0.83	11	N/A
Bradley Canyon Creek	312BCF	N/A	0.49	0.18	0.76	8	N/A
Bradley Channel	312BCU	N/A	0.51	0.13	1.26	15	N/A
Little Oso Flaco Creek	312OFN	N/A	0.14	0.05	0.26	25	N/A
Main Street Canal	312MSD, 312MSS	N/A	15.61	0.22	93.72	20	N/A
Orcutt (Solomon) Creek	312ORI, 312ORC,	N/A	0.42	0.02	1.11	33	N/A
Oso Flaco Creek	312OFC	N/A	0.40	0.07	1.00	16	N/A
Oso Flaco Lake	312OFL	N/A	0.23	0.02	0.63	16	N/A
Santa Maria River	312SMA, 312SMI	N/A	0.35	0.02	2.95	72	N/A

N/A: no water quality objective established in the Basin Plan.

Figure 4, and Figure 5 display the mean and range of nitrate and un-ionized ammonia data collected at each CCAMP site during 2000-01 in the Santa Maria hydrologic unit area. Sites are arranged in decreasing mean averages.

Water Board staff determined the Santa Maria River (312SMA, 312SMI), Main Street Canal (312MSD), Bradley Channel (312BCU), Bradley Canyon Creek (312BCF), Orcutt-Solomon Creek (312ORI, 312ORC, 312ORB), Oso Flaco Creek, Little Oso Flaco Creek and Oso Flaco Lake (312OFC, 312OFN, 312OFL) exceeded the maximum concentration 10 mg/L nitrate-N. Phosphate levels at Main Street Canal (312MSD) were significantly higher than those measured elsewhere in the Project Area. Water Board staff determined the Santa Maria River (312SMI), Main Street Canal (312MSD), Bradley Canyon Creek (312BCF), Blosser Channel (312BCD), Orcutt-Solomon Creek (312ORB, 312ORI) and Oso Flaco Creek (312ORC), exceeded the general water quality objective for un-ionized ammonia.

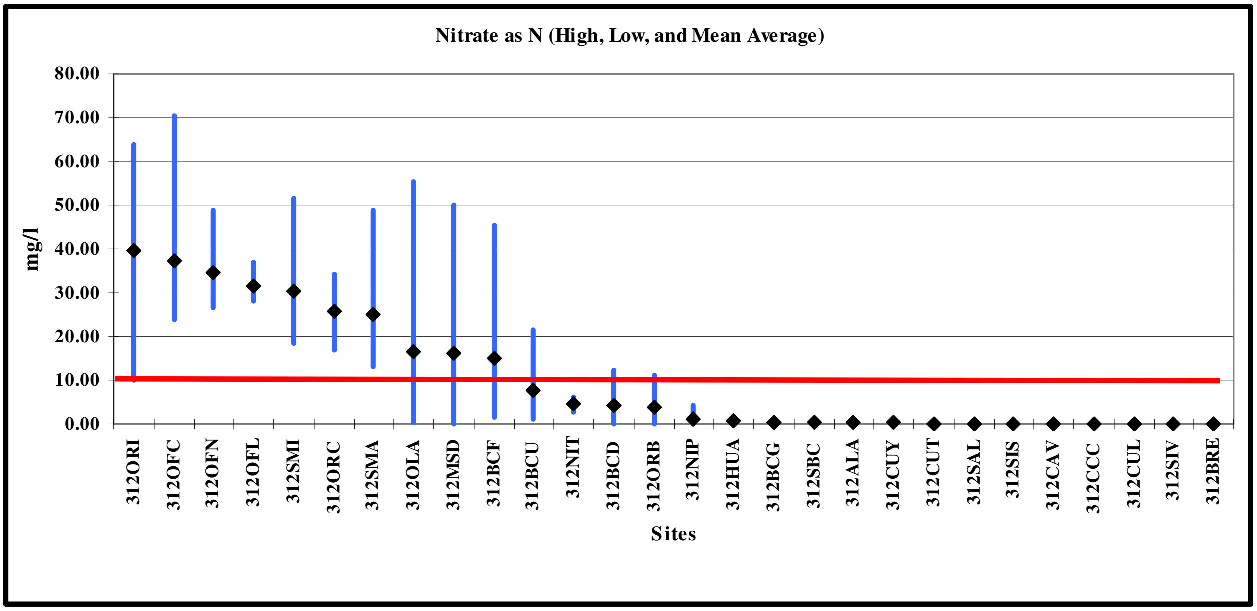

Figure 4. CCAMP ambient monitoring Nitrate Concentrations in the Santa Maria And Oso Flaco Watersheds (2000-01). ***Note: sites are arranged in decreasing mean averages; water quality objective shown in red. The units on the y-axis of the graphs are mg/L as N.***

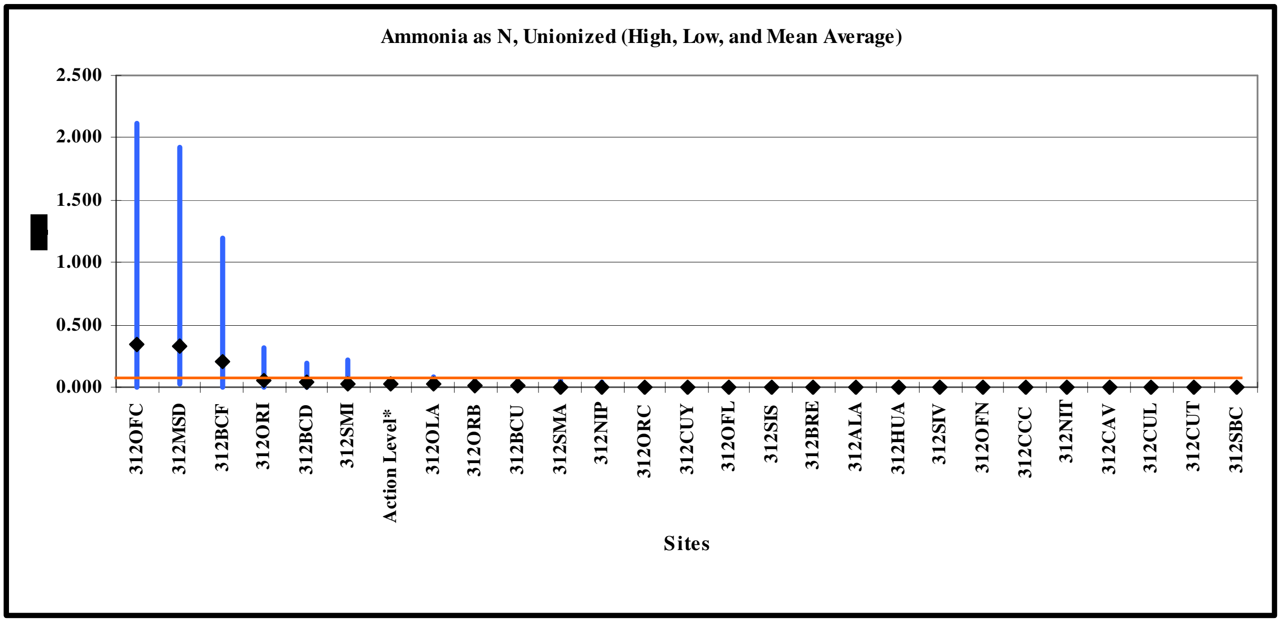

Figure 5. CCAMP ambient monitoring Un-ionized Ammonia Concentrations in the Santa Maria And Oso Flaco Watersheds (2000-01). ***Note: sites are arranged in decreasing mean averages; water quality objective shown in red. The units on the y-axis of the graphs are mg/L as N.***

Santa Maria River, Estuary, and Tributaries

CCAMP staff collected samples in the Santa Maria River at Highway 1 (312SMI) and further downstream at Rancho Guadalupe Dunes Preserve Road upstream of the estuary (312SMA) between January 2000 and February 2001 and January 2007 through February 2008. Sampling at 312SMA is continuous on a monthly basis through CCAMP's Coastal Confluences project; data for this site is shown through May 2005 in Figure 6. Nitrate levels measured in 2007-08 at 312SMA were less than those found in 2000-01 although levels exceeded the drinking water objective and range between 25 and 27 mg/L. Only one sample was obtained from 312SMI due to low flows.

Strong odors, cattle waste and hoof prints were observed on multiple sampling events in Santa Maria River at Highway One (312SMI) and above the estuary (312SMA). At each of these sites staff documented cattle grazing in the creek channel year round.

CCAMP staff also collected samples in Bradley Canyon Creek at Foxen Canyon Road (312BCF); Blosser Channel (312BCD) and Bradley Channel (312BCU), two concrete storm water conveyances; and Main Street Canal upstream of Ray Road at Highway 166 (312MSD), a storm water conveyance and agricultural drainage that flows to percolation ponds and then ultimately to the Santa Maria River. Nitrate levels at 312BCD measured in 2007-08 were within water quality objectives; nitrate levels at 312BCU were elevated above water quality objectives as shown previously in Table 5. No samples were taken in 2007-08 at 312BCF due to little or no flow. 312MSD and 312MSS were variable with samples exceeding water quality objectives.

The Main Street Canal is downstream of the city limits and receives both agricultural and urban inputs. Water Board staff recently requested that the City of Santa Maria determine the extent to which agricultural and urban areas drained to this water body. Main Street Canal has also recently undergone significant development; Blosser Channel drained to the Santa Maria River, and since data collection, was significantly modified in conjunction with adjacent urban development. As such, this water body no longer receives year-round flow from adjacent stormwater ponds. Bradley Channel received some runoff from the agricultural areas south of the City of Santa Maria and urban runoff from east of Highway 101 and drained to percolation ponds.

Concentrations of nitrate found at 312SMI were higher in 11/16 samples and more variable than those found downstream at 312SMA during 2000-01. Elevated nitrate levels at 312SMA continued through 2005. Nitrate concentrations along the Santa Maria River appear to be higher during the dry season, although exceedances were found during every month of the year. Preliminary data from 2006-07 showed similar trends.

CCAMP monitoring of stormwater channels in the City of Santa Maria between January 2000 and March 2001 (not graphed) indicated some elevated nitrate concentrations. Bradley Channel had three of fifteen samples exceeding the nitrate water quality objective for drinking water. Nitrate levels were also elevated at Bradley Canyon Creek at Foxen Canyon Road (312BCF) and Bradley Channel (312BCU).

Concentrations at the Main Street Canal (312MSD) were lower than those found in the Santa Maria River, but were still elevated above the nitrate water quality objective in eight of fourteen samples collected throughout the year.

Concentrations of un-ionized ammonia at Highway 1 (312SMI) were consistently elevated above the general water quality objective between January 2000 and March 2001 (not graphed). Concentrations downstream at 312SMA were within water quality objectives.

Un-ionized ammonia levels were elevated year-round at Main Street Canal (312MSD), Bradley Canyon Creek at Foxen Canyon Road (312BCF), and Blosser Channel (312BCD). Preliminary data from 2006-07 collected from the Santa Maria River indicate that ammonia levels were less than those measured during 2000-01; levels in Main Street Canal and Blosser Channel were still elevated.

Elevated ammonia levels in 2007-08 in the Main Street Canal prompted Water Board program staff to work with the City to develop map that show drainage to the Main Street Canal, to inspect industrial facilities in that area, and prioritize irrigated agricultural inspections so that drainage area is covered in the first round of inspections conducted under the irrigated agricultural waiver program.

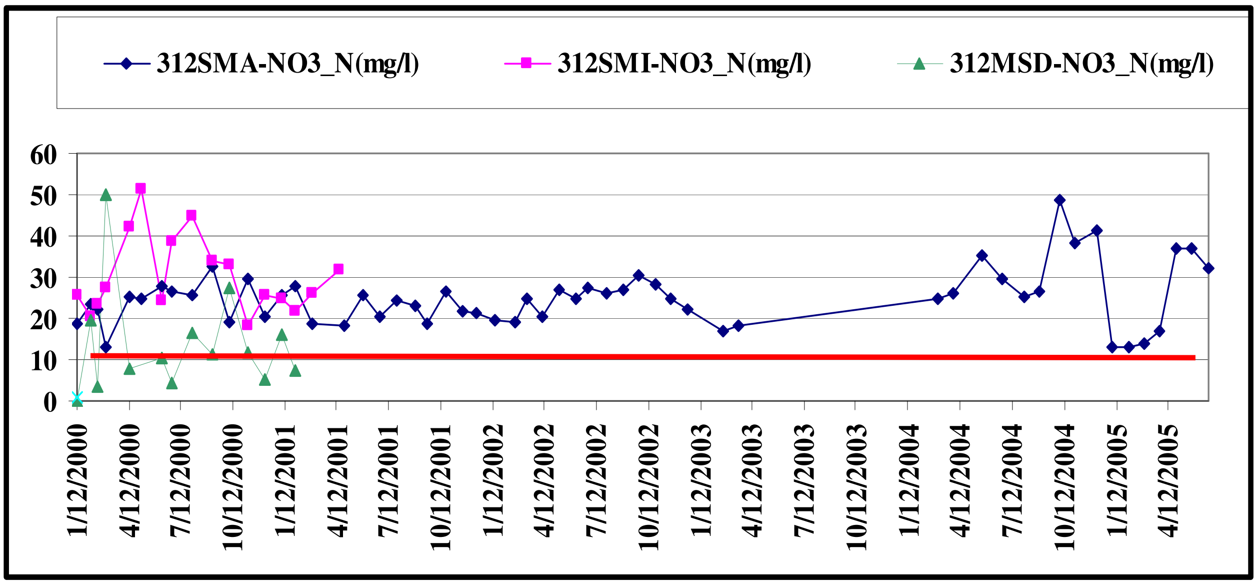

Figure 6. Nitrate Concentrations (mg/L as N) In The Santa Maria River At Highway 1 (312SMI), Santa Maria River At Rancho Guadalupe Dunes Preserve Road (312SMA), And Main Street Canal (312MSD) January 2000 To May 2005. ***Note: water quality objective shown in red. The units on the y-axis of the graphs are mg/L as nitrate as N.***

CCAMP staff collected samples at Orcutt-Solomon Creek between January 2000 and March 2001. Nitrate concentrations at three sites are displayed in Figure 8. The units on y-axis of the graph are mg/L as N. Orcutt-Solomon Creek at Rancho Guadalupe Dunes Preserve Road (312ORC) is about 500 meters upstream of the creek's confluence with the Santa Maria River.

Nitrate concentrations were higher and more variable at Highway 1 (312ORI), than further downstream at Rancho Guadalupe Dunes Preserve Road (312ORC) potentially due to draining agricultural land uses. Levels exceeded the water quality objective at both 312ORI and 312ORC year-round. Preliminary data from 2006-07 showed similar trends.

Water Board staff does not consider the most upstream site on Orcutt-Solomon Creek at Black Road (312ORB), a low flowing drainage, as impaired, as it exhibited low nitrate levels year-round. CCAMP staff collected data at Betteravia Lakes at Black Road (312OLA), but did not consider the data to be representative due to lack of flow. As such, data from 312OLA are not shown below.

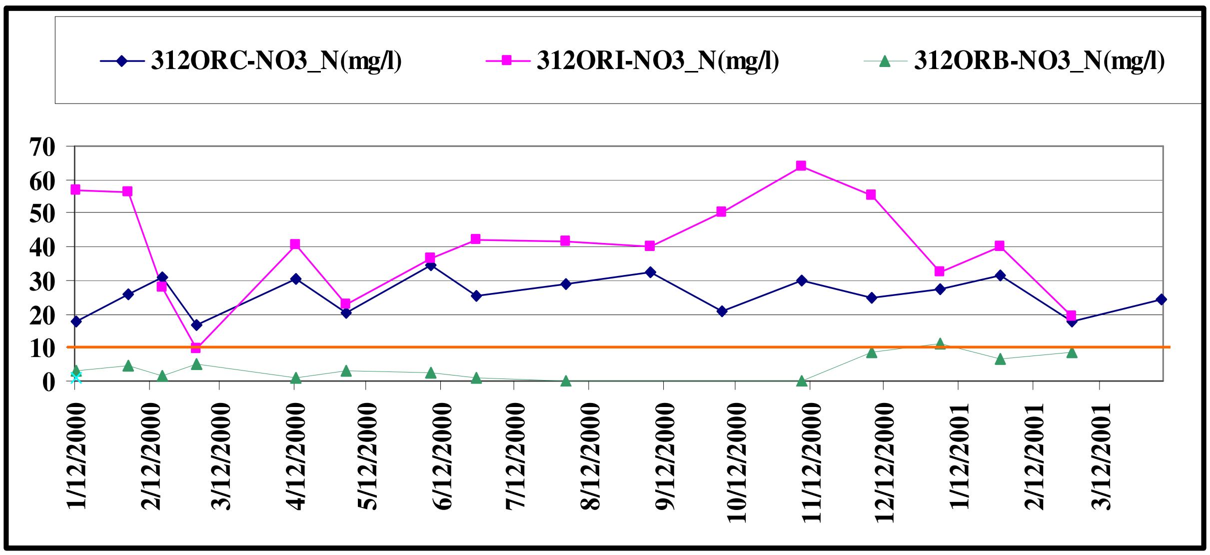

Figure 7. Nitrate Concentrations (mg/L as N) in Orcutt-Solomon Creek at 312ORC, 312ORI, and 312ORB, January 2000 to March 2001. ***Note: water quality objective shown in red. The units on the y-axis of the graphs are mg/L as nitrate as N.***

Un-ionized ammonia concentrations were higher at Highway 1 (312ORI), than further upstream at 312ORB. Levels exceeded the water quality objective at both 312ORI and 312ORB year-round. Concentrations of un-ionized ammonia at 312OR1 and 312ORB are shown in Figure 8. Preliminary data from 2006-07 collected from Orcutt Solomon Creek indicate that ammonia levels were less than those measured during 2000-01.

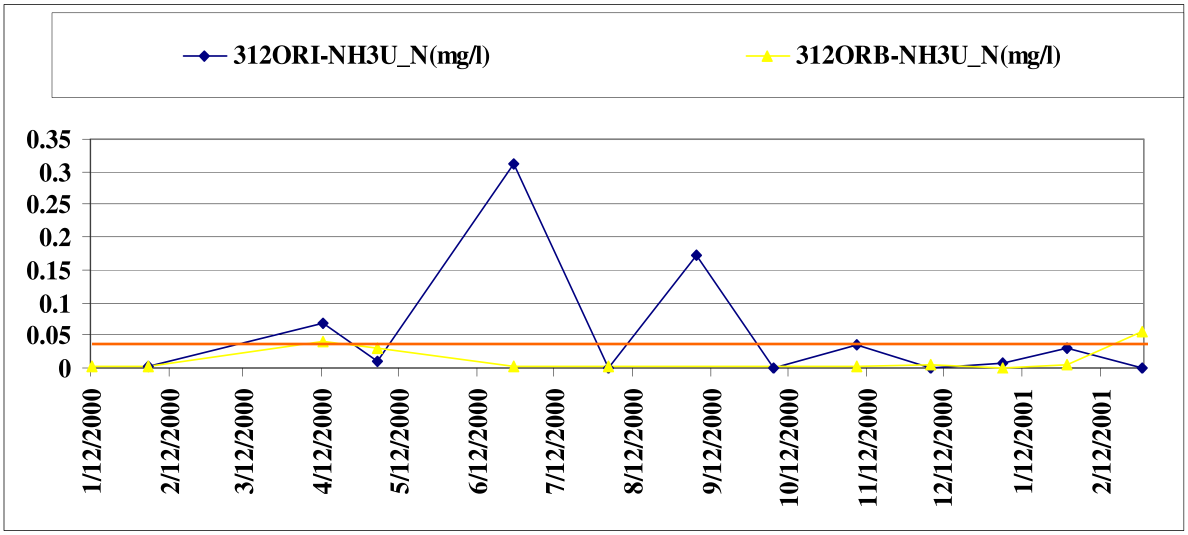

Figure 8. Un-ionized Ammonia Concentrations (mg/L as N) in Orcutt-Solomon Creek at 312ORI and 312ORB, January 2000 to March 2001. ***Note: water quality objective shown in red. The units on the y-axis of the graphs are mg/L as N.***

Oso Flaco Creek Watershed

CCAMP staff collected samples in the Oso Flaco watershed between January 2000 and April 2001. Nitrate concentrations are displayed in Figure 10. The units on the y- axis of the graph are mg/L as N. Nitrate concentrations at all sites were elevated above water quality objectives year round. Concentrations at Oso Flaco Creek at Oso Flaco Creek Road (312OFC) were more variable than those measured at Little Oso Flaco Creek (312OFN) and downstream at Oso Flaco Lake (312OFL). Preliminary data from 2006-07 collected from the Oso Flaco watershed indicate that nitrate levels were consistently elevated.

Little Oso Flaco Creek is not specifically listed as impaired on the 303(d) list. Water Board staff concluded that both Oso Flaco Creek and its tributary, Little Oso Flaco Creek were impaired for nitrate. As such, TMDLs will be developed for both water bodies. Oso Flaco Lake is on the 303(d) list as impaired for nitrate due to exceedances of the municipal and domestic supply beneficial use; however, this waterbody is not designated as supporting that beneficial use. As such, Water Board staff will not develop a nitrate TMDL for this water body, but rather a TMDL for nutrients to protect aquatic life beneficial uses due to elevated nutrient levels, excessive algal growth, and declining freshwater wetland plants.

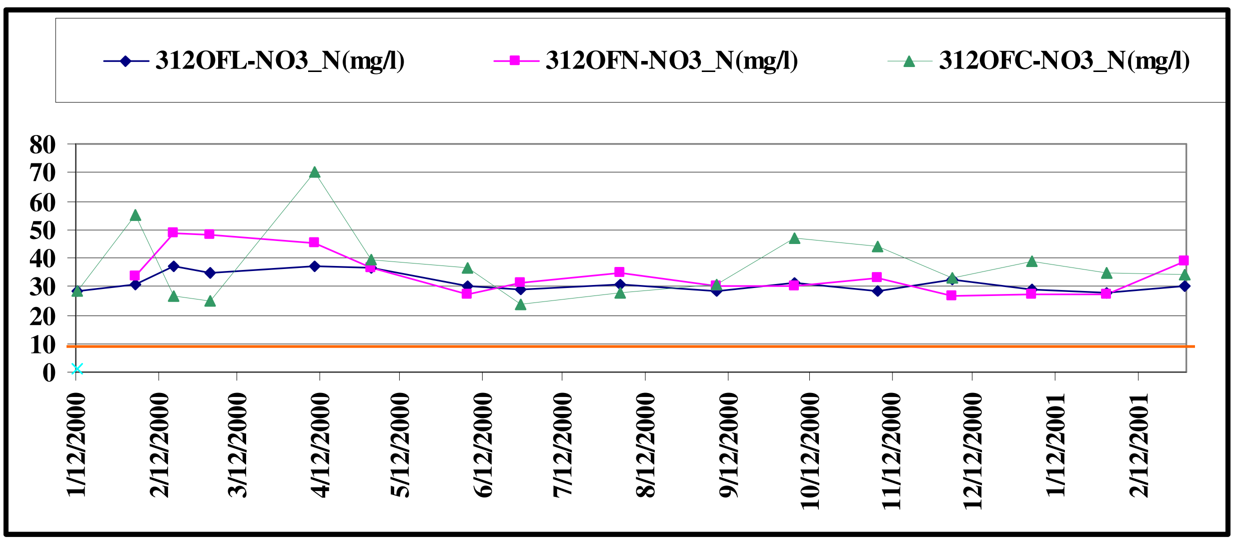

Figure 9. Nitrate Concentrations (mg/L as N) in the Oso Flaco Watershed, January 2000 To March 2001. ***Note: water quality objective shown in red. The units on the y-axis of the graphs are mg/L as N.***

Un-ionized ammonia concentrations (mg/L as N) at Oso Flaco Creek at Oso Flaco Creek Road (312OFC) were elevated above water quality objectives year round (Figure 10). Neither Oso Flaco Lake nor Little Oso Flaco Creek were impaired for un-ionized ammonia. Preliminary data from 2006-07 shows that ammonia levels in the Oso Flaco watershed were lower, with all data points meeting water quality objectives.

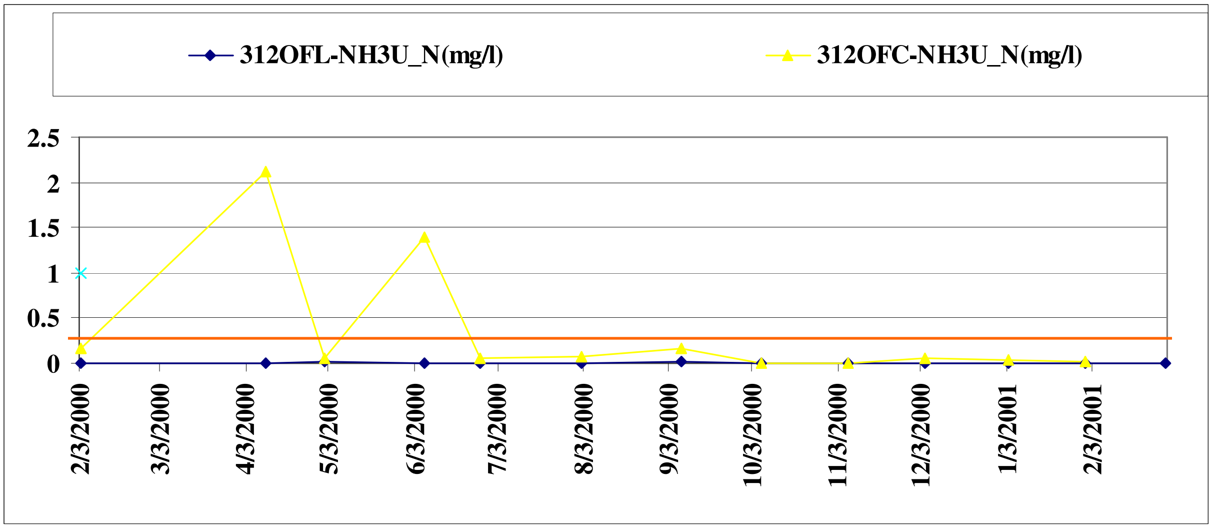

Figure 10. Un-ionized Ammonia Concentrations (mg/L as N) in the Oso Flaco Watershed, February 2000 to March 2001. ***Note: 312OFL is not impaired; water quality objective shown in red. The units on the y-axis of the graphs are mg/L as N.***

CCAMP Water Quality Data Conclusions

Nitrate

To consider a site impaired by nitrate concentrations, more than ten percent of the total samples must exceed the criteria. Table 5. displays the listing date and status, average, minimum, maximum, number of samples, and percent exceedances of the established nitrate municipal and domestic supply quality objectives at water quality monitoring sites.

As shown, staff found chronic exceedances of the nitrate objective for drinking water in Oso Flaco Creek sites (312OFC, 312OFN) and in the lower Santa Maria River upstream of the Estuary (312SMA) and at Highway 1 (312SMI). Orcutt-Solomon Creek flows into Santa Maria River upstream of the estuary. In the dry season this creek contributes approximately 90% of the total flow to the estuary (SAIC 2004). The monitoring site located upstream of this confluence on Orcutt-Solomon Creek (312ORC) also had extremely high nitrate concentrations year round, as did the upstream site at Highway One (312ORI). At each of these sites 100% of the samples collected between January 2000 and March 2001 exceeded the drinking water objective. Staff determined that Orcutt-Solomon Creek was not impaired upstream of 312ORB. Elevated nitrate concentrations were also measured regularly at sites located at Main Street Canal (312MSD) and Bradley Canyon at Foxen Canyon Road (312BCF). Each of theses sites had mean nitrate values that exceeded the water quality objective.

Additional sites with elevated nitrate levels that were not proposed for inclusion on the 2002 303(d) list include Betteravia Lakes at the Ray Road Culvert (312OLA) and Little Oso Flaco Creek (312OFN). Staff did not recommend listing Betteravia Lakes in 2002 based on site characteristics which were not representative of the waterbody. Little Oso Flaco Creek was not placed on the 2002 303(d) list, although it is impaired, and will receive a TMDL as part of this project.

Un-ionized Ammonia

The un-ionized ammonia water quality objective was exceeded at several sites in the Project Area. Table 6 displays listing date and status, average, minimum, maximum, number of samples, and percent exceedances of the established ammonia general toxicity water quality objectives at water quality monitoring sites. Two sites on the lower Santa Maria River (Highway One (312SMI) and above the estuary (312SMA) exceeded the general toxicity water quality objective in two of twelve samples. In Orcutt–Solomon Creek all sites had at least one exceedance of the objective. However, to consider a site impaired by un-ionized ammonia concentrations, more than ten percent of the total samples must exceed the criteria. Two Orcutt-Solomon Creek sites, Highway One (312ORI) and Black Road (312ORB), exceeded the criteria multiple times. Main Street Canal, which flows to Santa Maria River downstream of the City of Santa Maria, exceeded this criterion in eleven of twelve samples at 312MSD. Other tributaries to the Santa Maria River with more than ten percent of the total un-ionized ammonia samples elevated include Bradley Canyon Creek at 312BCF and Blosser Channel at 312BCD. These waters only flow to the River during the wet season.

Un-ionized ammonia was also elevated in Oso Flaco Creek at Oso Flaco Creek Road (312OFC) in nine of twelve samples collected between January 2000 and March 2001. This creek joins Little Oso Flaco Creek and flows to Oso Flaco Lake year round. No exceedances of the ammonia criterion were observed at the lake site (312OFL).

4.1.2. City of Santa Maria Stormwater Monitoring

The Water Board will be regulating stormwater through approval of Stormwater Management Plans that comply with the National Pollution Discharge Elimination General Permit (NPDES) for discharges (Permit No. CAS000004, Order No. 2003-0005-DWQ). The municipalities in the Santa Maria and Oso Flaco watersheds must obtain approval of these plans and comply with the general permit. Some municipalities are monitoring water quality as part of their proposed permit activities.

The City of Santa Maria began collecting data during storm events in 2004. City of Santa Maria staff chose monitoring stations to characterize land use contributions. Prell Basin primarily collected stormwater from agricultural areas to the West and was representative of flows which entered the City of Santa Maria. Hobbs Basin received urban runoff, and during overflows discharged to a channel along Stowell Road and eventually flowed to the Santa Maria River. The Main Street Channel consisted of two channels that ran on along Main Street and combined to become the Unit 2. Ditch, and discharged to the Santa Maria River. This site represented mixed contributions from urban and agricultural areas; Water Board staff were evaluating the relative contributions during the writing of this report.

City of Santa Maria staff plans to continue stormwater monitoring efforts indefinitely, with a minimum of three sampling events per wet season. Additional sampling will provide further information to characterize urban and agricultural inputs. Water Board staff concluded that urban runoff was likely a source of nitrate and un-ionized ammonia to the nutrient impairment.

Table 8 shows a summary of concentrations collected between 2004 and 2006 by the City of Santa Maria at four monitoring stations. Nitrate levels in the North Channel of the

Main Street Canal were higher (37 mg/L as N) than those measured elsewhere. Nitrate concentrations measured in stormwater runoff from Prell and Hobbs Basins and the South Channel of Main Street did not exceed water quality objectives. Un-ionized ammonia levels were not available, and staff recommends the City modify their MRP to include pH and temperature so that these values can be calculated.

Table 8 Summary of Stormwater Nitrate (mg/L as N) Collected by the City of Santa Maria Collected Between 2004 and 2006.

Station	Number of Samples	Nitrate Min	Nitrate Average	Nitrate Max
Prell Basin / West of Highway One and South of Nicholson Street	5	2.7	3.2	3.7
Hobbs Basin / South of Stowell Road and West of A Street	4	ND	1.3	1.8
Main St. Channel North / West Main and Hansen Lane which combine to become the Unit Two Ditch	4	2.2	14.2	37.0
Main St. Channel South / West Main and Hansen Lane which combine to become the Unit Two Ditch	5	1.0	2.3	5.9

4.1.3. Orcutt-Solomon Creek Storm Event Monitoring

Santa Barbara County's Project Clean Water sponsors studies to help identify pollution sources and develop an understanding of how those pollutants move through the environment. Project Clean Water staff conducted nitrate and ammonical nitrogen in Orcutt-Solomon Creek during four storm events at Black Road, monitoring site OR1 and at an upstream location, OR5. OR1 is the same location as CCAMP monitoring site 312ORB. Figure 11 shows the monitoring locations. Table 9 displays summary nitrate and ammonical nitrogen values.

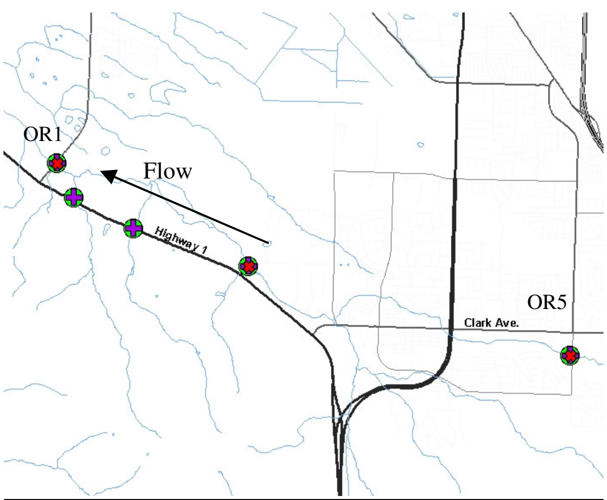

Figure 11. Project Clean Water Sampling Sites on Orcutt-Solomon Creek.

Table 9. Summary of stormwater Nitrate (mg/L as N) and Ammonical Nitrogen Concentrations Collected by Project Clean Water in 2002-2003.

Station	Number of Samples	Time period	Nitrate (mg/L) Min.	Nitrate (mg/L) Average	Nitrate (mg/L) Max.	Number of Samples	Time period	Ammonical Nitrogen (mg/L) Min.	Ammonical Nitrogen (mg/L) Average	Ammonical Nitrogen (mg/L) Max.
OR1	9	2/2000 - 2/2003	1.5	6.1	10.0	3	11/2002 - 2/2003	ND	0.2	0.5
OR5	7	1/2001 - 2/2003	ND	0.1	0.7	3	11/2002 - 2/2003	ND	0.1	0.2

Nitrate levels at OR1 ranged from 3.7 to 10.0 mg/L. Nitrate levels at OR5 were non-detectable levels of nitrate, with the exception of one sample (0.7 mg/L). No stormwater samples exceeded the nitrate water quality objective. Ammonical nitrogen levels at OR1 were higher than those measured at OR5.

4.1.4. Oso Flaco Nitrate Study

The Coastal Conservancy contracted with The Dunes Center to conduct an Oso Flaco Watershed Nitrate and Sediment Assessment. Objectives of the study included developing a nitrate model. As part of this effort, the Cachuma Resources Conservation District (CRCD) collected nitrate data in 2002-2003 at eight locations within the Oso Flaco watershed. Staff summarized data in Table 10. Urban stormwater discharges from the rural residential area of Nipomo Mesa to Oso Flaco watershed did not exceed water quality objectives; runoff did not occur during dry periods. Samples taken from Oso Flaco Creek, and Little Oso Flaco Creek exceeded water quality objectives, but were typically less than samples taken from unnamed agricultural ditches. Irrigated agricultural discharges occurred during both wet and dry seasons.

Table 10. CRCD Monitoring Locations and Ambient Data Summary (Nitrate (mg/L) as N) in the Oso Flaco Watershed in 2002-2003.

Station (s)	Primary land use/location within drainage area	Number of Samples	Min. (mg/L)	Average (mg/L)	Max. (mg/L)
Site 1	Urban runoff from Nipomo Mesa via stormwater collection system on Division Road; stagnant flow	3	2	2	3
Site 2	County Road Ditch Culvert Outlet. Intersection of Bonita School Road and Division Rd. West of BSRd, South side of Division.	13	13	82	137
Site 3	Ag Ditch Coming from County Road Ditch Culvert Outlet. North Side of Division Rd. Approximately 4,650 feet west /south west of the split in the road of Division and Oso Flaco Lake Road.	11	12	82	154
Site 4	County Road Ditch. Intersection of Highway 1 and Oso Flaco Lake Road. Southwest Quadrant. West of Highway 1 and south of Oso Flaco Lake Road.	13	9	42	111
Site 5	County Road Ditch along Oso Flaco Lake Road, just west of the railroad tracks. South of Oso Flaco Lake Road.	11	12	26	56
Site 6	Oso Flaco Creek just north of Oso Flaco Lake Road.	15	25	43	65
Site 7	Little Oso Flaco Creek just west of the train trestle.	15	18	41	76
Site 8	At the causeway at Oso Flaco Lake. Downstream end of two culverts.	15	29	38	52

4.1.5. Santa Maria Estuary Enhancement and Management Plan

The State Coastal Conservancy prepared the Santa Maria Estuary Enhancement and Management Plan (Plan) in March 2004. The Plan included water quality data collection and focused on nitrate inputs. Table 11 provides a data summary for this study. For additional information see reports in the Santa Maria Estuary Enhancement and Management Plan (*SMRE)* Study, Appendix B dated March 12, 2001 and October 23, 2002.

Table 11. Ambient Nitrate (mg/L as N) from the *SMRE* Study

November, 2001[a]	
Sampling location	Nitrate as N (mg/L)
Hwy 1	8.3 - 8.8
Lagoon	18 - 22
May, 2002[b]	
Hwy 1	9.6
8th Street	10.6
Ditch near Kiosk	28.1
Orcutt Creek	20.9
Lagoon	16.2

[a] Data from 2 daytime samples taken on 10/31 and 11/20, 2001 (MNE Letter Report dated March 12, 2002 (Appendix B).
[b] Mean data for 6 samples taken every 6 hours for 36 hours May 22 and 23 (graphs in MNE Letter Report dated October 25, 2002 (Appendix B).

According to the Plan, the nitrate concentrations measured at Highway 1 were lower than samples collected from the estuary. Researchers concluded this was likely due to substantial nutrient input from Orcutt-Solomon Creek combined with the drainage ditch near the kiosk to Rancho Guadalupe Dunes Preserve. Together these sources accounted for about 96% of the nitrate input to the estuary (*SMRE* Study, Appendix B, MNE report dated February 28, 2002).

The Plan also developed a water budget in the estuary and determined it was substantially affected by input from Solomon-Orcutt (Orcutt-Solomon) Creek and the drainage ditch near the kiosk. Combined, these two sources accounted for approximately 92% of the total inflow to the estuary. Water level rises in the estuary following rainfall when the barrier berm has not been breached and the rate of inflow (from upstream) exceeds the length and rate of seepage through the barrier berm to the ocean (about 0.8 cubic m/sec).

4.1.6. Case Study: Rangeland Management Measure Implementation Monitoring

In the Morro Bay watershed study (National Monitoring Program, 2003), Water Board staff collected nitrate data to evaluate the effectiveness of rangeland management practices. The data demonstrated nitrate in the creeks did not significantly change when management practices were implemented. This data suggested that rangeland practices were not a significant source of nitrate, and staff concluded this was likely the same for ammonia.

4.1.7. Wastewater Treatment Plant Monitoring

Several of the wastewater treatment facilities in the Santa Maria watershed collect water quality data. These include the following entities:

- the City of Santa Maria,
- the City of Guadalupe,
- the Laguna County Sanitation District,
- the Nipomo Community Services District, and
- the Community of Cuyama.

Water Board staff evaluated available effluent, surface and groundwater nitrate data collected by these agencies. The Nipomo Community Services District analyzes samples for total nitrogen, nitrate and nitrite, rather than for nitrate only. A summary of all data is shown in Table 12 and Table 13. Levels in effluent measured by the CSD since 2003 have not exceeded 2 mg/L.

Nipomo Community Services District is developing plans to upgrade the wastewater treatment plant. Water Board staff is currently evaluating sub-surface flow in order to draw definitive conclusions regarding the impact of effluent percolation to area groundwater.

As shown in Table 12, effluent and upgradient groundwater concentrations measured by the City of Santa Maria were above water quality objectives. Nitrate levels in groundwater downgradient were below the nitrate water quality objective. Effluent and groundwater concentrations measured by the City of Guadalupe were below water quality objectives, with the exception of levels measured upgradient of the wastewater spray field, which rose dramatically in 1998. Staff suspected the upgradient site was very shallow and likely impacted by perched effluent or some other source. As a result, the Water Board required the City of Guadalupe to perform a hydrogeological evaluation of the representative nature of the well and install new one if needed. The City of Guadalupe was investigating the elevated nitrate levels measured upgradient and down of the wastewater spray field, and was installing representative wells.

Water Board staff evaluated nitrate concentrations measured by the Laguna County Sanitation District in 2003 and 2005. Groundwater concentrations were below 10 mg/l with the exception of one sample collected downgradient in 2005. All effluent samples were below 10 mg/L with the exception of one sample collected in April 2003. Surface water samples collected in Orcutt-Solomon Creek were higher downgradient of the wastewater treatment plant than upgradient.

Water Board staff concluded effluent discharged from the wastewater treatment plants was not a significant source of nitrate to the Santa Maria River. Water Board staff concluded that ammonia discharged from the wastewater treatment plants was not likely a significant source of impairment to the listed waterbodies, mainly because the discharges were to land. Staff recommended adding un-ionized ammonia to each of the Monitoring Programs to confirm staff's conclusions.

Table 12. Summary of nitrate (mg/L as N) concentrations collected by area WWTPs.

	Period of data reviewed	Sampling frequency and location	Number of Samples	Min. (mg/L)	Average (mg/L)	Max. (mg/L)
Facility						
City of Santa Maria	2001, 2003-2005	Annual Effluent	4	0.5	5.5	13.5
		Quarterly Groundwater (upgradient)	16	0.9	12.37	88.0
		Quarterly Groundwater (downgradient) North Well	16	0.4	1.53	5.4
		Quarterly Groundwater (downgradient) South Well	16	0.1	0.6	2.0
City of Guadalupe	1998,1999,2002-2004	Annual Groundwater MW2,	1	0.2	0.2	0.2
		Annual Groundwater MW5	1	3.5	3.5	3.5
		Annual Groundwater MW6	4	0.2	0.23	0.3
		Annual Groundwater MW7 upgradient position relative to spray field	5	79.0	107.8	140.0
Laguna County Sanitation District	2000-2005	Annual Groundwater (upgradient)	6	0.2	3.3	9
		Annual Groundwater (downgradient)	6	0.3	4.9	11
		Quarterly Effluent	14	0.0	4.0	18
		Monthly Orcutt-Solomon Creek at Black Rd. (upgradient)	66	0.0	2.8	105.0
		Monthly Orcutt-Solomon Creek at Brown Rd. (downgradient)	67	0.5	27	190
Nipomo Community Services District	2000-2006	Semi-annual Groundwater , MW 1, Nitrate and Nitrite as N, mg/L	17	0	34	230
		Semi-annual Groundwater , MW 2, Nitrate and Nitrite as N, mg/L	17	2	12	33
		Semi-annual Groundwater , MW 3, Nitrate and Nitrite as N, mg/L	16	13	33	78
		Effluent, Nitrate and Nitrite as N, mg/L	11	0	26	206

1 individual numerical values not available to compute averages
2 parameter measured is Total N

Table 13. Summary of Ammonia-Nitrogen Concentrations Collected by Area WWTPs.

	Period of data reviewed	Sampling frequency and location	n	Min. (mg/L)	Average (mg/L)	Max. (mg/L)
Facility						
City of Santa Maria	2001, 2003-2005	Annual Effluent	4.0	0.0	10.3	18.0
Laguna County Sanitation District	2000-2005	Quarterly Effluent	14	0.8	18.6	28.0
		Monthly Orcutt-Solomon Creek at Black Rd. (upgradient)	58.0	0.0	0.9	8.1
		Monthly Orcutt-Solomon Creek at Brown Rd. (downgradient)	58	0.0	2.7	56.0

Staff also evaluated information provided by agency staff, and spill reports from each of the sanitary districts. This is discussed in the following section, 5.2.5. WDR Permitted Facilities.

4.1.8. Santa Maria Sanitary Landfill

The Santa Maria Sanitary Landfill is located east of the Santa Maria River and is regulated via the NPDES Industrial Stormwater General Permit. The City of Santa Maria takes annual nitrate samples at two stormwater discharge points (SW-1 and SW-2) and surface water samples as part of their industrial stormwater monitoring program. Ammonia was not analyzed in surface water samples, and permitting staff determined that this was not causing impairments as ammonia is volatilized after biosolids applications.

Water Board staff evaluated annual nitrate stormwater data collected in between 2001 and 2004. Concentrations in four stormwater samples taken from the two sites were variable, with samples averaging 4.2 mg/L as N. All samples were below the nitrate water quality objective, with the exception of one sample (16 mg/L) taken from the upstream site, SW-2 in 2004. These sites included drainage from adjacent agricultural lands. As part of the permit, staff recommended using the EPA guidelines, or benchmark standard based on the National Urban Runoff median concentrations of 0.68 mg/L for NO_3-N in stormwater.

Water Board staff evaluated annual nitrate surface water data collected in January 2006 upstream of the landfill. Nitrate levels were non-detectable in surface water samples taken from Bradley Channel and the Twitchell Release Point.

Water Board staff concluded the landfill was not a significant source of nitrate nor ammonia to the Santa Maria River.

4.1.9. Santa Maria Valley Groundwater Basin Data

Water Board staff prepared a report titled, Assessment of Nitrate Contamination in Groundwater Basins of the Central Coast Region (December 1995). This report documented nitrate contamination of groundwater between 1951 and 1995 based on drinking water well data. The report included an assessment of specific groundwater basins in the Central Coast Region and concluded the Santa Maria Valley groundwater basin had significant nitrate contamination. The report indicated the presence of several nitrate plumes in the vicinity of Nipomo and Santa Maria, with nitrate levels reaching 13 mg/L and 20 mg/L (as N), respectively. As part of the 1995 report, Water Board staff recommended additional monitoring be conducted and a groundwater nitrate management plan be developed.

Staff concluded that due to the surface water and groundwater system interface, groundwater is closely related to the waterbody impairments. The impacts of the degraded groundwater to the listed water bodies; however, have not been quantified at the time of this document preparation.

4.1.10. Department of Public Health Groundwater Data

Department of Public Health collected groundwater data throughout the region from deep water supply wells. Figure 12 displays the location of all the groundwater monitoring sites in the Santa Maria and Oso Flaco watersheds. Water Board staff evaluated data collected between 1985 and 2000. Groundwater nitrate concentrations measured on the Nipomo Mesa and within the Oso Flaco watershed were within water quality objectives. Groundwater nitrate concentrations in the Santa Maria Valley were elevated, with numerous sites consistently exceeding the water quality objective of 10 mg/L nitrate as N. Table 14 displays summary statistics for sites with elevated nitrate levels. Figure 12 displays all of the monitoring sites in the project area, and Figure 13 displays the names of sites in the lower Santa Maria Valley.

Table 14. Summary of nitrate-N concentrations (mg/L as N) in public drinking water wells with elevated nitrate levels in the Santa Maria Valley.

Monitoring site	Count (n)	Min. (mg/L)	Average (mg/L)	Max. (mg/L)	Sum > 10 mg/L
10N/34W-14E04 S	13	ND	11.7	17.8	10
10N/34W-14E05 S	9	ND	12.1	16.7	8
10N/34W-27L01 S	39	ND	6.4	15.4	7
10N/34W-35C01 S	32	1.8	8.1	12.8	6
10N/34W-32Q01 S	62	0.4	8.5	12.2	7
10N/34W-35P01 S	26	6.9	10.4	13.9	14
10N/34W-35P02 S	31	5.6	8.7	14.2	5

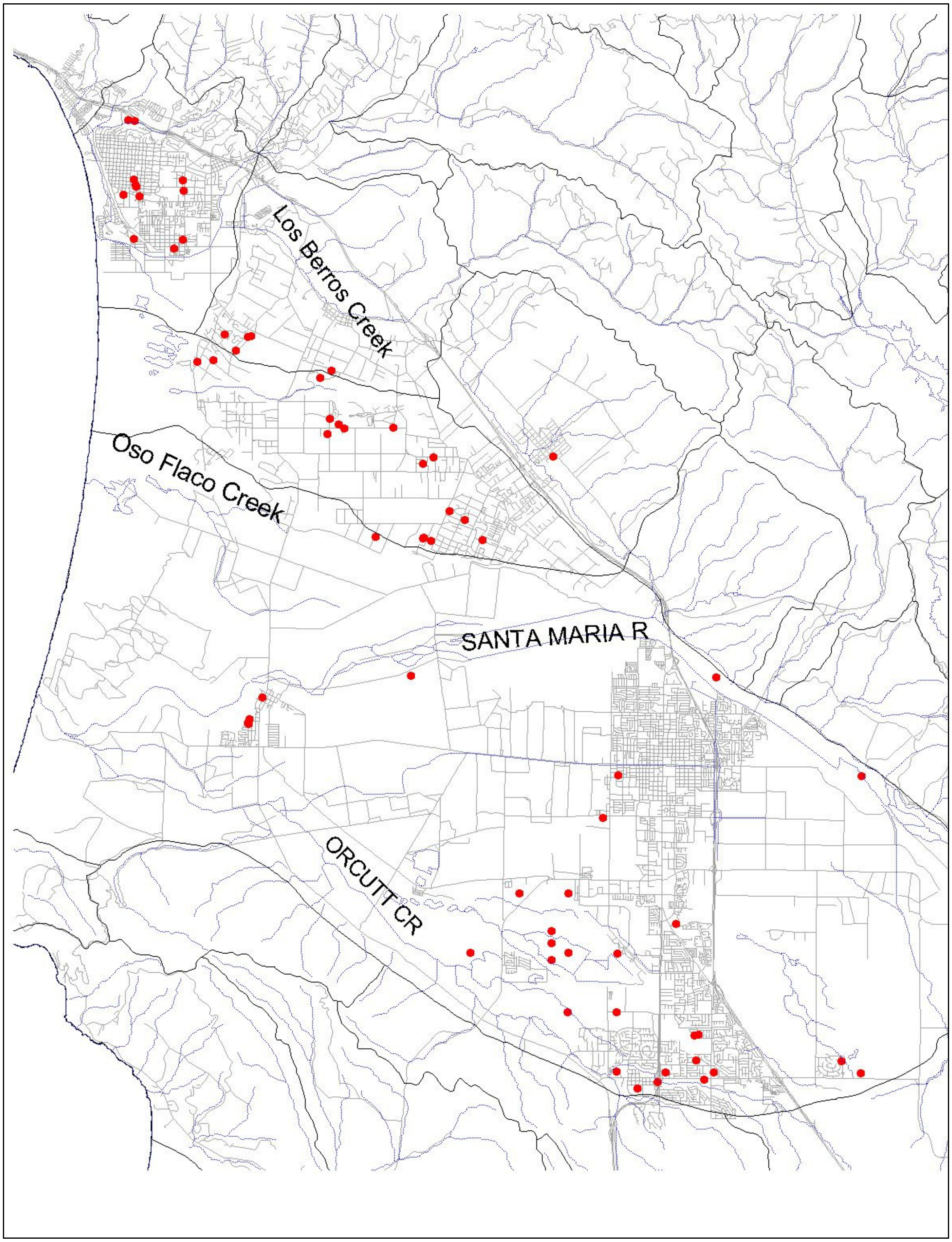

Figure 12. Groundwater Monitoring Sites of Public Drinking Water Supply Wells within Santa Maria and Oso Flaco Watersheds.

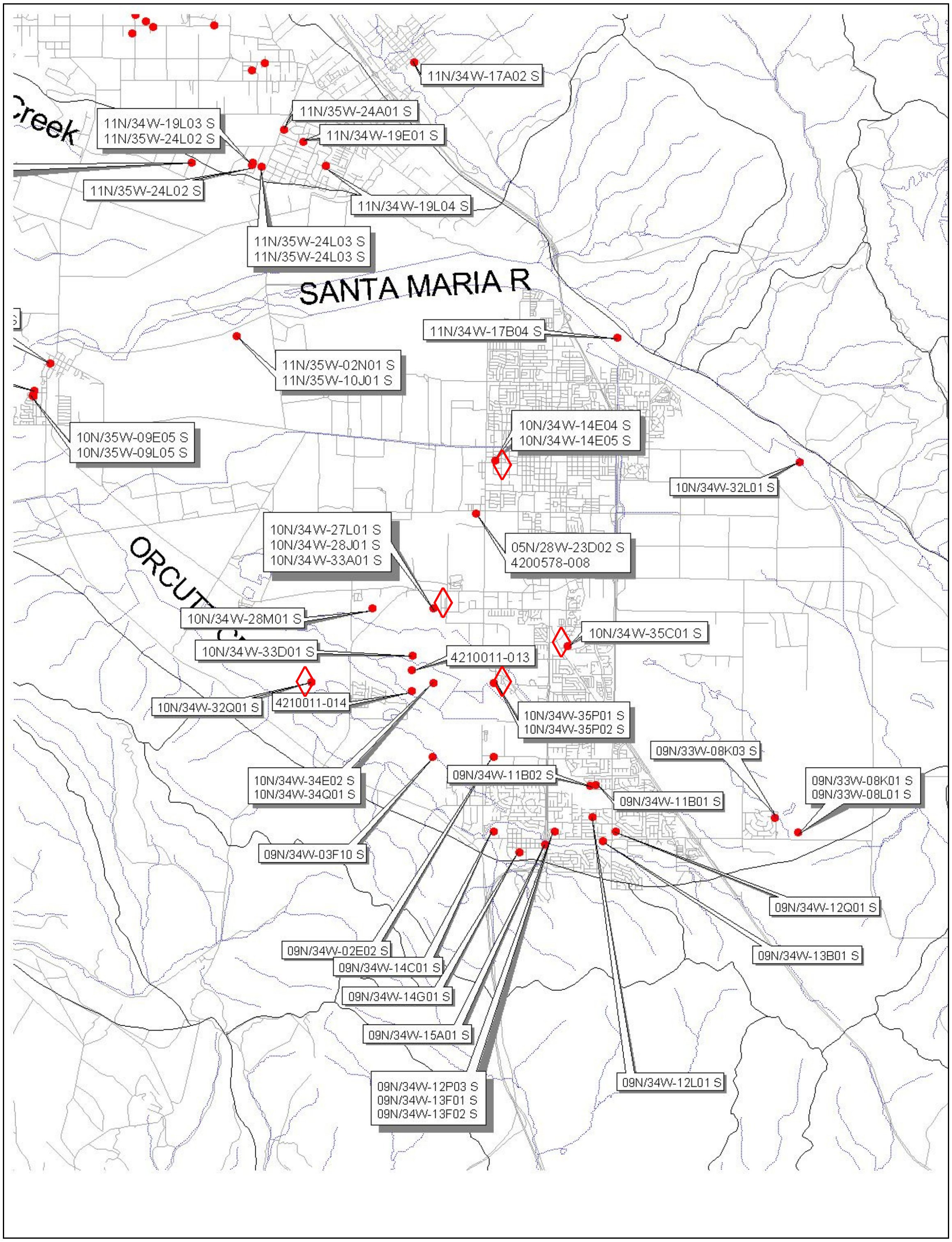

Figure 13. Groundwater Monitoring Sites of Public Drinking Water Supply Wells within the Lower Santa Maria Watershed. *Note: Monitoring wells with elevated nitrate levels are indicated with a ◊.*

4.1.11. Santa Maria Basin Oil Field Assessment

Komex Inc. prepared a report for the Water Board under the Santa Maria Basin – Oil Field Water Quality Assessment Project (the Project) in accordance with the National Fish and Wildlife Foundation (NFWF) Guadalupe Oil Field Settlement Water Quality Trust Grant (No. F98-289-5). The purpose of the project was to perform a potential water resources impact assessment resulting from crude oil and natural gas production in the Santa Maria Valley.

As part of the project, Komex Inc. collected surface water samples during storm events and groundwater samples from existing monitoring wells and accessible private domestic water wells. Water Board staff reviewed the data collected and determined the following:

- All surface water samples collected during storm events were below the nitrate water quality objective, and
- Groundwater samples collected from private domestic monitoring water wells include: South of the Santa Maria River near Sisquoc, GW2 (29 mg/L nitrate-N), Southeast of the City of Santa Maria, GW6 (37 mg/L), Southwest of the City of Santa Maria, GW7 (12 mg/L), and East of Hwy 1 near Orcutt Solomon Creek, GW8 (22 mg/L) exceeded the nitrate water quality objective (as N).

4.1.12. Santa Maria Oil Refinery

The ConocoPhillips (formerly Tosco) Santa Maria Oil Refinery is located on the Nipomo Mesa approximately 1 mile northeast of Oso Flaco Lake. At the time of this document preparation, the refinery discharged treated wastewater and storm runoff to the Pacific Ocean and was regulated under Waste Discharge Requirements**.** The refinery also has an NPDES permit and discharged to the ocean. Staff concluded this discharge did not impact the listed waterbodies.

Water Board staff reviewed a compilation of site-wide groundwater monitoring data collected between 1996 and 2000 to determine if there were impacts to the listed water bodies from the refinery (e.g. landfarms, storage, disposal ponds, percolation ponds, sewer lines, stockpiles, process areas, septic system, coke piles, refinery derived landfills).

Water Board staff reviewed groundwater data collected in April 2000 and January 2001. Water Board staff found nitrate levels in groundwater taken from 9 of 19 monitoring wells in 2000 exceeded the water quality objective; nitrate levels ranged from 0.53 to 22.8 mg/L as N. Water Board staff found that nitrate levels (as N) in groundwater were roughly 2-3 times higher upgradient (19.9 mg/L), in the center of the refinery (19-3 - 22.8 mg/L), and at the coke facility (22.5 mg/L), than elsewhere under the property. Water Board staff evaluated nitrate concentrations from a site background monitoring well (BC-1). The monitoring well BC-1 had elevated levels of nitrate-N in 2000 (19.9 mg/L), indicating an upgradient source.

Water Board staff concluded that the groundwater nitrate concentrations at the refinery exceeded nitrate water quality objectives; however, the sources of elevated nitrate concentrations in groundwater were unknown. Additionally, the hydrologic influences from groundwater on the Nipomo Mesa to the listed water bodies within the Oso Flaco watershed were unknown. Water Board staff concluded the refinery operations were not a significant source of nitrate nor ammonia to groundwater –- nor to the listed water bodies. Water Board staff will evaluate whether additional monitoring requirements are needed for refinery operations to further validate they are not a source of impairment to the Oso Flaco water bodies and include this in the Final Project Report.

4.1.13 Black Lake Canyon Field Survey

In 1998, the Land Conservancy of San Luis Obispo County contracted with M. McEwen to evaluate the factors which may affect the growth of Gambel's watercress (*Rorippa gambelii*) and marsh sandwort (*Arenaria paludicola*). As part of the study, researchers collected water and habitat quality data at six locations in Black Lake along with additional comparison sites, including one location near Little Oso Flaco Lake, where Gambel's watercress had been found in the past (1989).

Nitrate levels found near Little Oso Flaco Lake (site R3) were the highest (reaching 75 mg/L), while those measured in Black Lake (site R9) were less than 0.5 mg/L. Data suggested that if either of these species were able to thrive in each environment, then nitrate may not be a significant factor. One result of the study suggested phosphate may correlate with the survival of the species of interest, possibly due to the wide range of phosphate levels found near Little Oso Flaco Lake. Researches were unable to locate Gambel's watercress near Little Oso Flaco Lake during the study. Overall, researchers were unable to determine conclusively which water quality factors, if any, were critical constraints to the growth and/or propagation of the species due to the wide range of conditions. The study recommended additional monitoring, including collecting nitrate and phosphate surface water samples in Little Oso Flaco Lake.

According to Land Conservancy staff (B. Stark, pers. comm. July 23, 2007), these plants may not be affected directly by the elevated levels of nutrients, but could be encroached upon by other more aggressive species that are increasing due to elevated nutrients.

4.1.14. Agricultural groundwater and field runoff monitoring

In 2006, the CRCD, Southern San Luis Obispo and Santa Barbara Counties Agricultural Watershed Coalition (Watershed Coalition), and Water Board staff partnered to obtain data from groundwater used for irrigation and field runoff from agricultural lands. Quality assurance and control measures followed SWAMP and CCAMP standard operating procedures. The objectives of monitoring were as follows:

- To quantify the differences in nitrate concentrations between groundwater and field runoff from agricultural lands.
- To correlate these data collected with specific management practices, where possible; and
- To utilize these data in combination with the Cooperative Monitoring Program data and Central Coast Ambient Monitoring Program (CCAMP) data to better educate growers about water quality issues in the Santa Maria River and Oso Flaco watersheds.

Irrigation water from groundwater wells and runoff samples were taken from two irrigated agricultural fields. Specific samples were named by 1) 312 Hydrologic Unit Area, 2) sample type (ground water - GW, field runoff - FR) and 3) study site A or B (alphabetically) with the following site tags: 312GW-A, 312FR-A; 312GW-B, 312FR-B. The results of the effort are included in Table 15.

Table 15. Summary of nitrate concentrations (mg/L as N) in irrigation water from groundwater wells and field runoff on irrigated agricultural lands, March 2006.

SITE	Nitrate as N (mg/L)
312GW-A	32
312FR-A	47
312GW-B	27
312FR-B	25

Monitoring was short-term due to lack of landowner's interest in participating. Despite the limited measurements, Water Board staff concluded nitrate concentrations (in both runoff and groundwater) exceeded the water quality objective; nitrate concentrations in field runoff from the two sites varied in comparison to groundwater concentrations with higher concentrations than groundwater at one site (47 mg/L) and lower at the other (25 mg/L).

4.1.15. Conditional Agricultural Waiver Program's Cooperative Monitoring Program

The Conditional Agricultural Waiver Program's Coordinated Monitoring Program (CMP) included monthly testing of nitrate, phosphate, and total ammonia, along with flow and numerous other parameters. CMP sites included many existing CCAMP sites along with two additional sites (312BCC and 312GVS). Tables 14, 15, and 16 show summary statistics including percent exceedance of nitrate, un-ionized ammonia and phosphate objectives or threshold values (10 mg/L, 0.025 mg/L, 0.12 mg/L). As shown, average levels of nitrate/nitrite and ammonia far exceeded 10 mg/L. and 0.025 mg/L, respectively. Phosphate levels and flow are also shown.

Table 16. Summary of ambient nitrate/nitrite data (mg/L as N) during Phase 1 of the Cooperative Monitoring Program, 2005-2007.

	Flow (CFS)	Nitrate/Nitrite as N (mg/L)				
	Ave	Ave	Min	Max	Count	% Exceedance of 10 mg/L-N
312BCC	1.07	28.9	4.26	112	13	62%
312BCJ	4.64	32.4	0.14	95	28	82%
312GVS	1.99	56.7	10.5	138	31	100%
312MSD	2.25	22.4	1.98	72.6	24	75%
312OFC	3.39	38.8	2.88	63.7	35	93%
312OFN	1.06	40.7	7.9	62	28	96%
312ORI	9.27	52.9	8.3	91.8	31	97%
312ORC	11.94	34.6	12.9	58.1	29	100%
312SMI	0.936	31.5	11.5	81.9	12	100%
312SMA	12.32	30.7	3.13	56	29	93%

Table 17. Summary of ambient un-ionized ammonia data (mg/L as N) during Phase 1 of the Cooperative Monitoring Program, 2005-2007 (calculated from total ammonia and field measures of pH and water temperature).

	Flow (CFS)	Ammonia as N (mg/L)				
	Ave	Ave	Min	Max	Count	% Exceedance of 0.25 mg/L-N
312BCC	1.07	0.077	0.0002	0.679	19	42%
312BCJ	4.64	0.3993	0.004	8.26	33	55%
312GVS	1.99	0.1049	0.0002	2.37	36	25%
312MSD	2.25	0.213	0.0018	2.24	24	63%
312OFC	3.39	0.0153	0.0007	0.148	35	14%
312OFN	1.06	0.0072	0.0008	0.0427	35	3%
312ORI	9.27	0.053	0.0014	0.8436	36	31%
312ORC	11.94	0.0135	0.0005	0.0581	36	3%
312SMI	0.936	0.0081	0.0006	0.0125	18	0%
312SMA	12.32	0.0132	0.0012	0.0591	36	8%

Table 18. Summary of ambient phosphate data (mg/L as P) during Phase 1 of the Cooperative Monitoring Program, 2005-2007.

	Flow (CFS)	Orthophosphate as P (mg/L)				
	Ave	Ave	Min	Max	Count	% Exceedance (CCAMP Non-Regulatory Guideline 0.12 mg/L)
312BCC	1.07	1.77	0.0038	12.1	19	95%
312BCJ	4.64	0.666	0.0038	4.17	33	88%
312GVS	1.99	0.22	0.112	0.8283	36	58%
312MSD	2.25	4.85	0.0038	36.02	24	96%
312OFC	3.39	0.2	0.0038	1.11	35	69%
312OFN	1.06	0.149	0.0038	0.66	34	53%
312ORI	9.27	0.372	0.0038	1.36	36	89%
312ORC	11.94	0.35	0.0038	1.14	36	92%
312SMI	0.936	0.125	0.0038	0.37	18	50%
312SMA	12.32	0.291	0.0005	1.77	36	92%

Orcutt-Solomon Creek displayed seasonal trends, with nitrate levels higher in the dry season and phosphate levels higher in the wet season.

Samples were tested for toxicity using three test organisms (invertebrate, fish and algae). Most samples were toxic to invertebrates at each of the sites and also had elevated levels of organo-phosphate pesticides diazinon and chlorpyrifos. Elevated ammonia concentrations coincided with fish toxicity on one occasion at 312ORC, 312OFN and on two occasions at 312GVS and 312BCJ. This data will also be used for the pesticide TMDLs for these waterbodies.

4.1.16. Nutrient data comparison to aquatic life criteria

Staff evaluated data pertaining to nutrient impacts to aquatic life from biostimulatory processes, both algal growth and associated dissolved oxygen levels, and to freshwater wetland rare and endangered plants.

Dissolved oxygen
The Central Coast Basin Plan (Water Board, 1994) identified Santa Maria River and Cuyama River as both cold and warm water habitat. The Sisquoc River is identified as cold-water habitat. Specific dissolved oxygen criteria apply to each beneficial use. Waters designated as cold-water habitat are not to have oxygen levels below 7.0 mg/L at any time; warm-water habitats are to have dissolved oxygen concentrations above 5.0 mg/L.

Dissolved oxygen data was collected by CCAMP staff monthly at sites throughout the watershed between January 2000 and March 2001. In addition pre-dawn dissolved oxygen measurements were taken at most sites (those safely accessible between 3 am and 5 am) during summer months to target lowest probable levels. The Santa Maria River site up-stream of the estuary (312SMA) and Oso Flaco Lake (312OFL) were not accessible as they are behind locked gates after sunset.

Dissolved oxygen levels were below the assessment thresholds (more than 10% of total dissolved oxygen samples below 5.0 mg/L) at sites in the Cuyama and Santa Maria watersheds, including Bradley Channel (312BCU) and Blosser Channel (312BCD).

An additional Basin Plan objective that applies to all waterbodies states that “median values shall not fall below 85% saturation as a result of controllable water quality conditions”. The only site in the Hydrologic Unit with median oxygen saturation levels below 85% was Bradley Canyon Creek at Foxen Canyon Road (312BCF), which has intermittent summer flows and standing water through the fall. These low measurements are likely the result of flow conditions and were not representative of the creek as a whole. Table 19 shows CCAMP dissolved oxygen assessment of results.

To summarize, the following water bodies and corresponding monitoring sites are not meeting one or more established water quality objectives for dissolved oxygen and are therefore not supporting aquatic life-related beneficial uses:

- Santa Maria River (monitoring site: 312SMA)
- Oso Flaco Lake (monitoring site: 312OFL)
- Blosser Channel (monitoring site: 312BCD)
- Bradley Channel (monitoring site: 312BCU)
- Bradley Canyon Creek (monitoring site: 312BCF)

Water Board staff relied on numeric nutrient guidelines to support interpretation of narrative nutrient objectives. State Board staff recently developed numeric evaluation guidelines for nutrients (i.e., total nitrogen and total phosphorus). Staff relied on these methodologies detailed in the report: “Technical Approach to Develop Nutrient Numeric Endpoints for California” developed by Tetra Tech Inc. Staff discussed these further previously, in the Numeric Targets Section.

Biostimulatory Risk

Understanding how to manage surface waters for biostimulation is complex, as interactions and effects of excessive nutrients are not always readily apparent. CCAMP developed a “Biostimulatory Risk Index” to serve as a screening tool to simultaneously consider factors which serve as stimuli (e.g. nutrients), in parallel with those which act as responders (e.g. algal and plant cover, pH, dissolved oxygen and water column chlorophyll concentrations).

As discussed in Section 3.2, CCAMP developed the Biostimulatory Risk Index as a screening tool to evaluate sites for risk of problems associated with eutrophication. The Biostimulatory Risk Index simultaneously considers factors which serve as stimuli (nutrient concentrations), in parallel with those which act as responders (pH, dissolved oxygen, algal and plant cover, water column chlorophyll concentrations). Staff established a maximum index score of 0.40 to indicate risk for biostimulation and impairment of aquatic life uses. This score was based on the knowledge of sites that commonly show signs of impairment, including algal blooms, widely ranging dissolved oxygen concentrations, and elevated nutrient concentrations.

Evaluation of biostimulatory risk for all sites monitored by CCAMP in the Central Coast Region resulted in the identification of a threshold score for determining risk of biostimulatory conditions. Several sites in the Santa Maria Hydrologic Unit had Biostimulatory Risk scores which averaged above 0.40, including all sites in the lower Santa Maria watershed with the exception of the Santa Maria River at Bull Canyon crossing (312SBC). Indices used to evaluate risk of biostimulation (algal blooms) and the health of instream invertebrate communities indicated that both sites in the lower Santa Maria watershed were in poor condition. While not listed as impaired for nutrients, Alamo Creek also showed potential for biostimulatory risk.

In general, Biostimulatory Risk Index scores were highest in areas of the Central Coast Region already known to suffer from very high levels of nutrients. Sites in the upper quartile of ranked scores (highest risk for biostimulation) included Little Oso Flaco Creek, Main Street Canal, Orcutt-Solomon Creek and Blosser Channel.

Sites in the Sisquoc and Cuyama River watershed did not show evidence of biostimulatory risk, as identified by the Biostimulatory Risk Index. Although this index may have indicated impairment of aquatic life uses at some sites, it was not used alone as an assessment threshold.

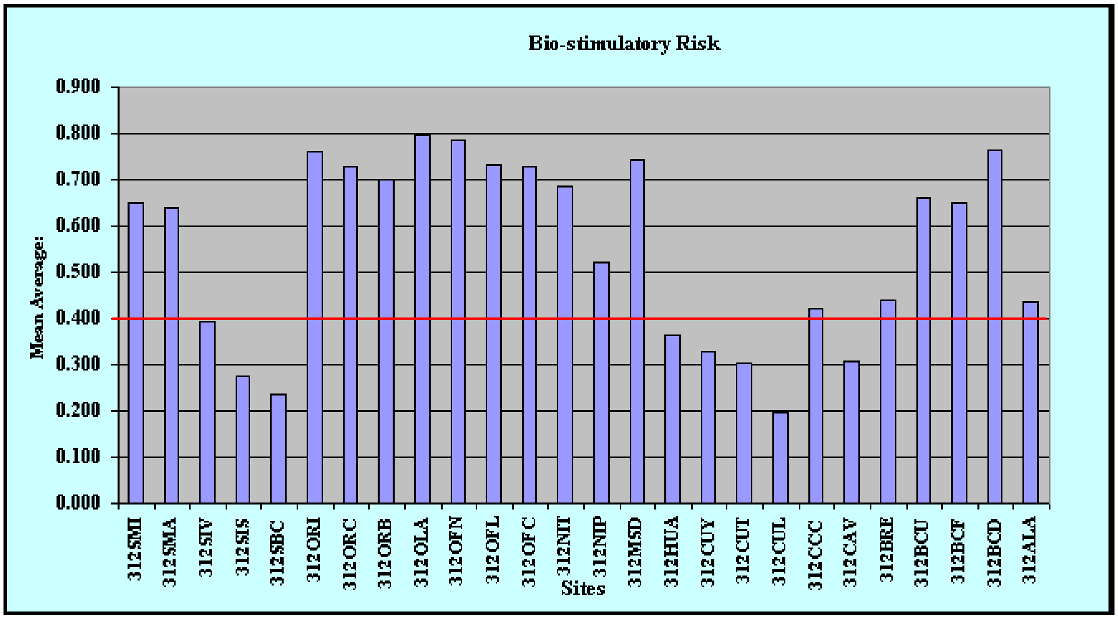

Figure 14. Average Biostimulatory Risk Index score for sites in the Santa Maria Hydrologic Unit, January 2000 through March 2001. Red line is at the threshold for risk of eutrophication.

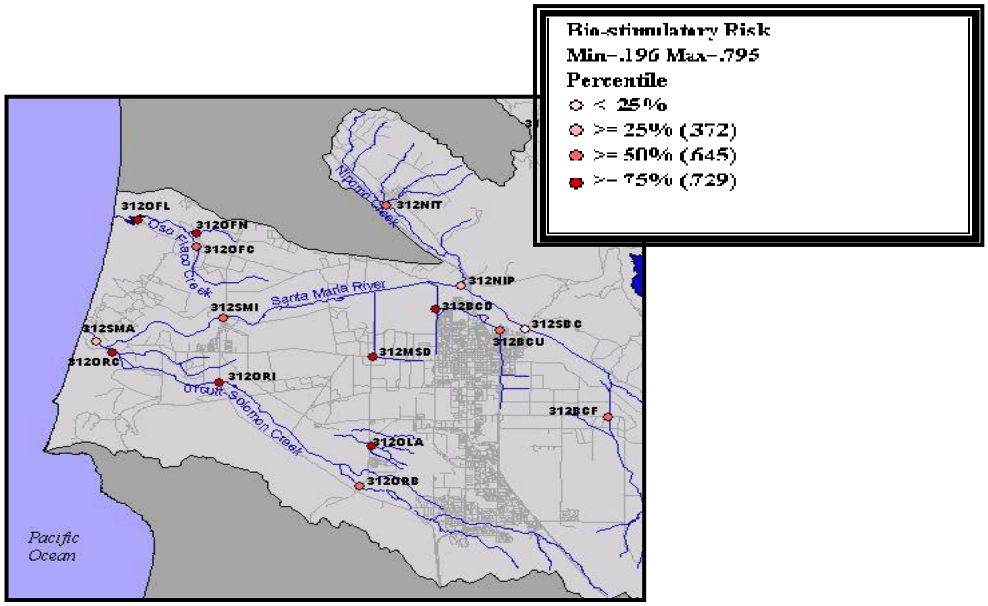

Figure 15. Percent quartile rank of the Biostimulatory Risk Index scores at sites in the Lower Santa Maria River Hydrologic Unit. Low risk sites score 0.40 or less (light pink shades) and high risk sites score 0.60 or higher (dark red shades).

CCAMP Index of Biotic Integrity (CCAMP IBI)

Benthic macroinvertebrates were collected from ten sites in the Santa Maria Hydrologic Unit in spring of 2000 and 2001. CCAMP IBI scores are a relative ranking and sites which score less than 3.0 on the CCAMP IBI are considered to be in poor condition based on macroinvertebrate assemblages. Because samples were collected at all sites in two consecutive years and each year the sampling effort consists of 3 composite samples per site (as specified by the CSPB protocol, Harrington 1999), the mean CCAMP IBI score for a site represented six samples. Although this index may have indicated impairment of aquatic life uses at some sites it was not used alone as an assessment threshold.

At all sites sampled on the Santa Maria River (312SMA, 312SMI and 312SBC), Orcutt-Solomon Creek (312ORC) and at one site on the Cuyama River below Twitchell (312CUT), average CCAMP IBI scores below 3.0. The substrate at each of these sites was either sand or mud dominated and riparian vegetation was relatively sparse on the wetted banks. In addition, nutrient and organic chemical concentrations in the lower Santa Maria and Orcutt-Solomon Creeks may have impacted aquatic invertebrate communities.

Relatively healthy benthic invertebrate communities were found at both sites on the Sisquoc River (312SIV and 312SIS) and at the upper most Cuyama River site at Highway 33 (312CAV). Figure 16 shows CCAMP IBI scores of benthic invertebrate communities. Staff considers those with benthic invertebrate community index scores in the highest quartile (over 0.60) as healthy. At each of these sites, gravel and cobble habitats were dominant and samples were collected in riffle habitats.

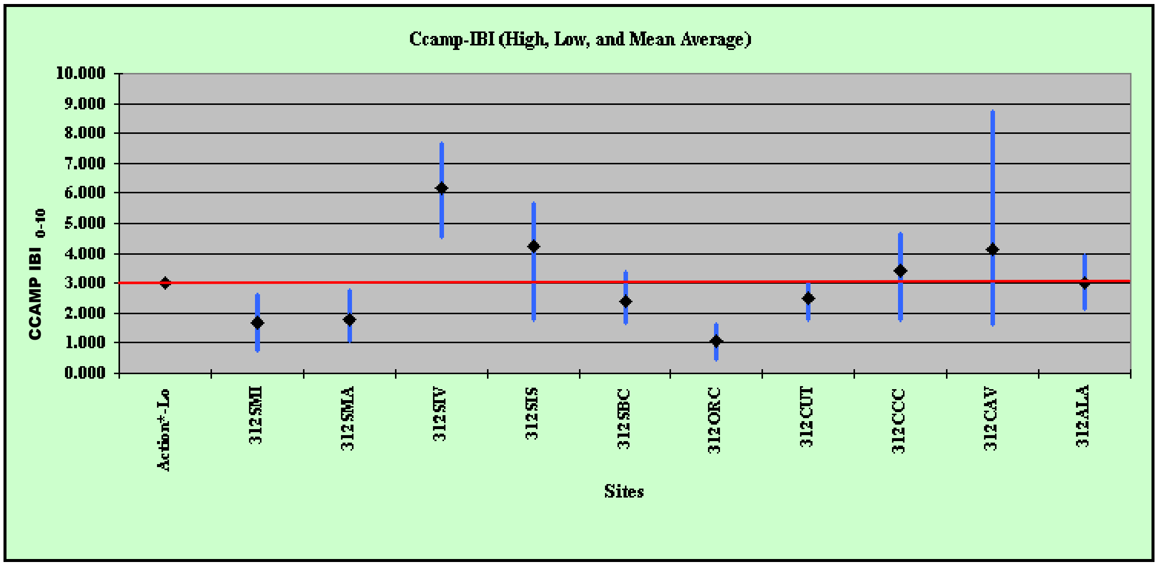

Figure 16. Range and average CCAMP IBI scores for sites in the Santa Maria Hydrologic Unit between April 2000 and May 2001. Red line is at 3.0, the score below which macroinvertebrate assemblages are considered in poor condition.

Table 19 shows CCAMP assessment results. Assessments were made by comparing data to the available criteria. Assessment thresholds for numeric criteria required a minimum of five samples and ten percent of total samples exceed a criterion. Assessment thresholds based on indices (bioassessment and biostimulation) did not incorporate a minimum sample count.

Table 19. Site specific assessment of data used to assess impairment of aquatic life uses. * less than 80% survival and significantly different than control.

Constituent	Ammonia as N, Un-ionized	Oxygen, Dissolved	Oxygen, Saturation	Toxicity	Bio-stimulatory Risk
Water Contact Recreation Assessment Threshold	0.025	<7 or <5	Median <85	<80% *	0.4
Units	ppm	ppm	%	% survival	
Matrix	H20	H20	H20	H20 or Sed	NA
Sites					
312ALA	No	**No**	**S**	-	**Yes**
312BCD	**Yes**	**Yes**	**S**	-	**Yes**
312BCU	**S**	**Yes**	**S**	-	**Yes**
312BCF	**Yes**	**S**	**Yes**	-	**Yes**
312MSD	**Yes**	**S**	**S**	**Yes**	**Yes**
312CAV	No	No	**S**	-	**S**
312CCC	No	No	No	-	**Yes**
312CUY	No	No	No	-	**S**
312CUT	No	No	No	-	**S**
312HUA	No	No	**S**	-	**S**
312BRE	No	**S**	**S**	-	**Yes**
312NIT	No	**S**	**S**	-	**Yes**
312NIP	**S**	**S**	**S**	-	**Yes**
312ORB	**Yes**	**S**	**S**	-	**Yes**
312OLA	**S**	**S**	**S**	-	**Yes**
312ORI	**Yes**	No	S	**Yes**	**Yes**
312ORC	No	No	No	**Yes**	**Yes**
312OFN	No	**S**	**S**	-	**Yes**
312OFC	**Yes**	No	S	**Yes**	**Yes**
312OFL	No	**S**	**S**	-	**Yes**
312SBC	No	No	No	-	S
312SMA	**Yes**	No	No	**Yes**	**Yes**
312SMI	**Yes**	**S**	**S**	**Yes**	**Yes**
312SIS	No	No	No	-	**S**
312SIV	No	**S**	**S**	NO	**S**

Yes - evidence that a problem exists
No - no evidence that a problem exists
S – some evidence that a problem may exist (i.e. a non-threshold value is exceeded or less than five exceedances observed) or dash symbol (-) indicates data is not available for this parameter.

CCAMP staff noted that recreational fishing was common at Oso Flaco Lake and on the beach at Santa Maria River Mouth and the discharge point to the ocean for Oso Flaco Lake. Although unlikely, recreation activities are possible at most other sites throughout the rotation area. The presence of nuisance algae, scum and odors can negatively affect recreation at these sites or downstream at the beaches. Algal mats, which persist throughout the summer months, can be detrimental to non-contact beneficial uses. Staff documented that algae at Oso Flaco Lake interfered with fishing and wildlife viewing throughout the summer. Algae were not present at most other sites, likely due to lack of substrate for attachment. Staff photo-documented algae in Oso Flaco Lake in September 2007 as shown in Figure 17.

Figure 17. Algae in Oso Flaco Lake, September 2007.

To summarize, the following water bodies and corresponding monitoring sites are impaired by biostimulatory substances, and are therefore not supporting aquatic life-related beneficial uses:

- Santa Maria River and Estuary (monitoring site: 312SMA)
- Bradley Canyon Creek (monitoring site: 312BCF)
- Bradley Channel (monitoring site: 312BCU)
- Blosser Channel (monitoring site: 312BCD)
- Main Street Canal (monitoring site: 312MSD)
- Orcutt- Solomon Creek (monitoring sites:312ORI and 312ORC)
- Oso Flaco Creek (monitoring site: 312OFC)
- Little Oso Flaco Creek (monitoring site: 312OFN)
- Oso Flaco Lake (monitoring site: 312OFL)

Potential Impacts to Freshwater Wetland Plants in Oso Flaco Watershed

In February 2007, USFWS staff raised concern about the potential effects of elevated nutrient levels to the federally endangered *Arenaria paludicola* (marsh sandwort), *Nasturtium* [*Rorippa*] *gambelii* (Gambel's watercress), California least tern (*Sterna antillarum browni),* and threatened California red-legged frog (*Rana aurora draytonii*). Marsh sandwort and Gambel's watercress are critically imperiled and their survival may depend upon the health of the Oso Flaco watershed. The last remaining known population of marsh sandwort and one of the last two remaining known populations of Gambel's watercress occur in Oso Flaco Lake.

USFWS staff recommended that the Water Board list Oso Flaco Lake and Oso Flaco Creek as impaired bodies of water for nutrients and establish TMDLs. The levels for which these TMDLs are set in this watershed may have a significant effect on survival and recovery of these two critically endangered species. Water Board staff evaluated impacts of nutrients to aquatic life and associated habitats. This analysis is presented below.

A healthy aquatic plant community plays a vital role within the lake community. Aquatic plants help improve water quality, provide valuable habitat resources for fish and wildlife, help resist invasions of non-native species and check the excessive growth of tolerant species that could crowd out the more sensitive species, thus reducing diversity (Konkel, 2006). Oso Flaco Lake is not healthy because the plant community is un-natural, altered by many factors, one being a dramatic changing in the nutrient regime. The Oso Flaco watershed has been highly modified to align with roads and agriculture fields along its course. Substantial recovery of aquatic systems would be expected from changes in nutrient levels.

In addition, Oso Flaco Lake is an important wildlife area, and provides habitat for migratory waterfowl. The lake is also a popular spot for wildlife viewing and fishing.

Most earlier toxicological studies have been concerned with algae, and other aquatic plants have been studied only rarely. Hunding (1978) found that many factors may modify the toxic effect of a substance on the growth of aquatic plants, including biomass.

According to a studies done by the Wisconsin Department of Natural Resources on Lake Mallalieu in 1999-2001, land use can strongly impact the aquatic plant community and, therefore, the entire lake community. Practices on shore can directly impact the plant community through increased sedimentation from erosion, increased nutrients from fertilizer run-off and soil erosion and increased toxics from farmland and urban run-off. Researchers also combined relative frequency and relative density into a Dominance Value to indicate the dominance of species within the macrophyte community.

The beneficial uses for Oso Flaco Lake and Oso Flaco Creek included Rare, Threatened, or Endangered Species; Wildlife Habitat; and Preservation of Biological Habitats of Special Significance. The Central Coast Basin Plan narrative objective for bio-stimulatory substances states: "Waters shall not contain bio-stimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses". Konel (2001, 2006), Moore et al. (1988), and Weiher and Keddy (1995) determined that the input of nutrients (e.g., nitrate, un-ionized ammonia, phosphate) to fresh water bodies can cause changes to the aquatic plant community.

The California State Water Resources Control Board (2006) developed water quality indicator threshold values (California State Water Resources Control Board, Clean Water Act Section 305b Report, California Coastal Waters and Wadeable Streams, 2006). The following threshold values for water quality are shown in Table 20.

Table 20. Water Quality Indicator Threshold Values, 2006.

	Dissolved Oxygen	Nitrogen	Phosphorus	Chlorophyll *a*
High Quality	> 5 mg/L	<.5 mg/L	<0.01 mg/L	<5.0 µg/L
Moderate	2-5 mg/L	0.5-1.0 mg/L	0.01-0.1 mg/L	5.0-20 µg/L
Low Quality	<2 mg/L	>1.0 mg/L	>0.1 mg/l	>20 µg/L

Staff evaluated aquatic life conditions in Oso Flaco Lake and Oso Flaco Creek. Table 21 shows a comparison of biostimulatory risk indicators versus water sample taken from Oso Flaco Lake in 2000-2001. Nitrogen and phosphorus levels and indicator threshold scores suggest Oso Flaco Lake does not meet the beneficial use criteria for biostimulatory substances.

Based on data from California Coast Ambient Monitoring Program (CCAMP, 2002), Surface Water Ambient Monitoring Program (SWAMP) (California State Water Resources Control Board 2006), and McEwen (2000), Oso Flaco Lake and Oso Flaco Creek have excessively high nutrient levels and warrant being listed as impaired water bodies because of adverse effects from the nutrients.

Table 21. Summary of aquatic life conditions in Oso Flaco Lake, 2006.

From: California State Water Resources Control Board; *Clean Water Act Section 305b Report,* California Coastal Waters and Wadeable Streams, 2006	Oso Flaco Lake - Central Coast Ambient Monitoring Program, 2002 - Water Quality Sampling 2000 – 2001		
	Max	Min	Mean
"Less than 1% of coastal waters sampled had concentrations greater than 1.0 mg/L nitrogen."	37.1 mg/L nitrogen	28 mg/L nitrogen	31.3 mg/L nitrogen
"52% of the estuarine waters had dissolved inorganic phosphorus levels less than 0.01 mg/L."	0.48 mg/L phosphorus	0.3 mg/L phosphorus	0.376 mg/L phosphorus
"Chlorophyll *a* concentrations in estuarine waters were generally low, approximately 87% of the area with concentrations less than 5 ug/L."	160 ug/L chlorophyll *a*	1 ug/L chlorophyll *a*	26 ug/L chlorophyll *a*

Dodds et. al. (1998) published classified waters exceeding 1.5 mg/L total nitrogen and/or total phosphorus exceeding 0.075 mg/L as eutrophic. CCAMP data documented that Oso Flaco Lake and Oso Flaco Creek are considerably above these levels; these conditions are being exacerbated by excessive nutrient levels.

Based on the evidence cited above, Oso Flaco Lake and Oso Flaco Creek: 1) have nutrient inputs above concentrations known to adversely affect freshwater ecosystems including affecting the composition of the plant community (approximately 1 mg/L total nitrogen, or 0.07 mg/L total phosphorus); and 2) suffer from and display the effects of biostimulation. A proposed TMDL based on risks of adverse ecological effects is likely to be sufficiently protective of the endangered species in Oso Flaco Lake. Staff recommended that the TMDLs for Oso Flaco Lake and Oso Flaco Creek be based on all nutrient inputs, rather than being based solely on nitrate and ammonia drinking water standards and that the nutrient TMDLs be based on levels determined to be below the risk for biostimulation.

4.1.17. Nitrate Impacts to Sensitive Crops

CCAMP staff evaluated nitrate impacts to sensitive crops. In waters that could be used for irrigation purposes, the Central Coast Basin Plan states that nitrate above 30 mg/L as N could have negative effects on sensitive crops. Average nitrate concentration at Santa Maria River at Highway 1 (312SMI), Orcutt-Solomon Creek at Highway 1 (312ORI), Oso Flaco Creek (312OFC) and Little Oso Flaco Creek (312OFN) and Oso Flaco Lake (312OFL) exceed this criterion (Figure 18).

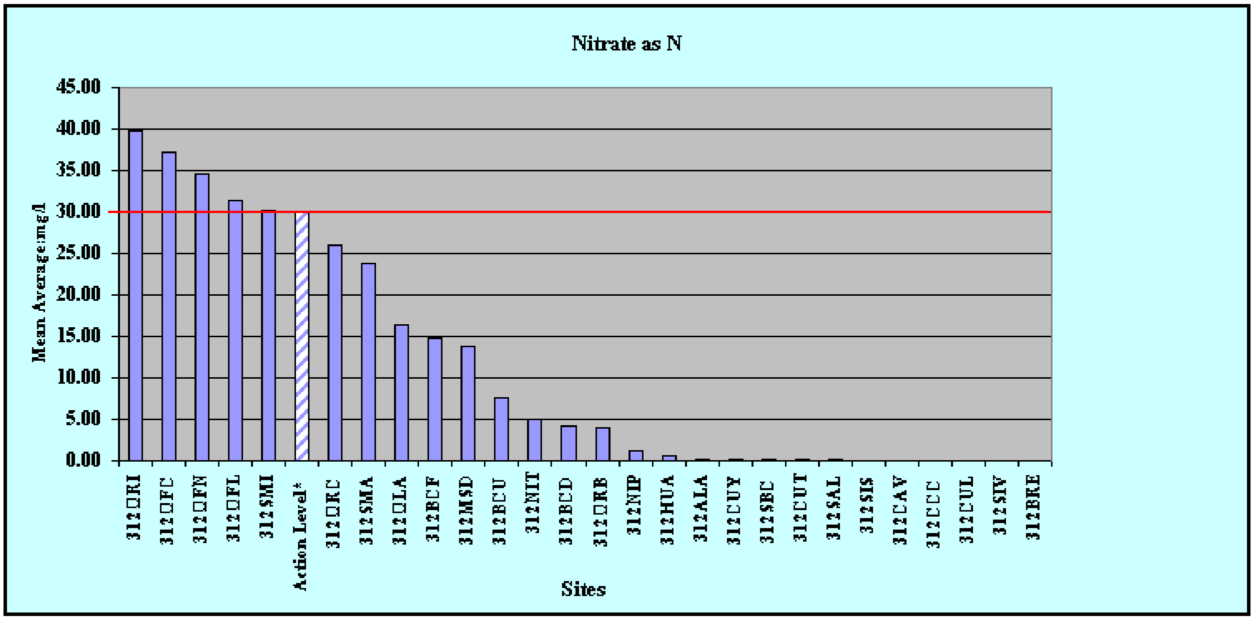

Figure 18. Average nitrate concentration (mg/L as N) for sites in the Santa Maria Hydrologic Unit relative to the irrigated agriculture beneficial use objective (red line and striped bar), January 2000 to March 2001.

4.2. Flow Data

The Santa Maria River is characterized by lower dry-season flows than wet-season flows, and lower year-round flows than those found further upstream in the Cuyama River and Sisquoc River.

The United States Geological Survey (USGS), the County of Santa Barbara, CCAMP, and the CMP collected flow data in the project area. The USGS collected data at numerous locations in the Santa Maria River. Table 22 shows mean monthly flow data.

Table 22. Flows (cfs) in the Santa Maria River, Cuyama River, and the Sisquoc River (1940-1999).

	time period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Santa Maria River at Guadalupe	**1940-1987**	60	74	137	76	3.1	0.02	0.01	0	0.09	0.03	0.71	11
Cuyama River (Below Twitchell Dam)	**1958-1983**	27	26	65	33	80	97	94	83	62	31	27	26

Sisquoc River (near Sisquoc)	**1943-1999**	83	179	151	97	35	13	5.3	2.7	2.6	2.7	6.8	27

The Santa Barbara County Water Agency (SBCWA) also collects hydrologic data for use in numerical modeling to track and address regional water conservation strategies, and water use efficiency, water supply, and sedimentation into the County's water supply and storage facilities.

CCAMP staff began collecting flow at 312SMA in February 2005. Flow was also measured by the CMP, as shown previously with CMP water quality data. Figure 19 shows mean monthly flow in cubic feet per second (cfs) at the Santa Maria River, Cuyama River, and Sisquoc River during January (1) – December (12).

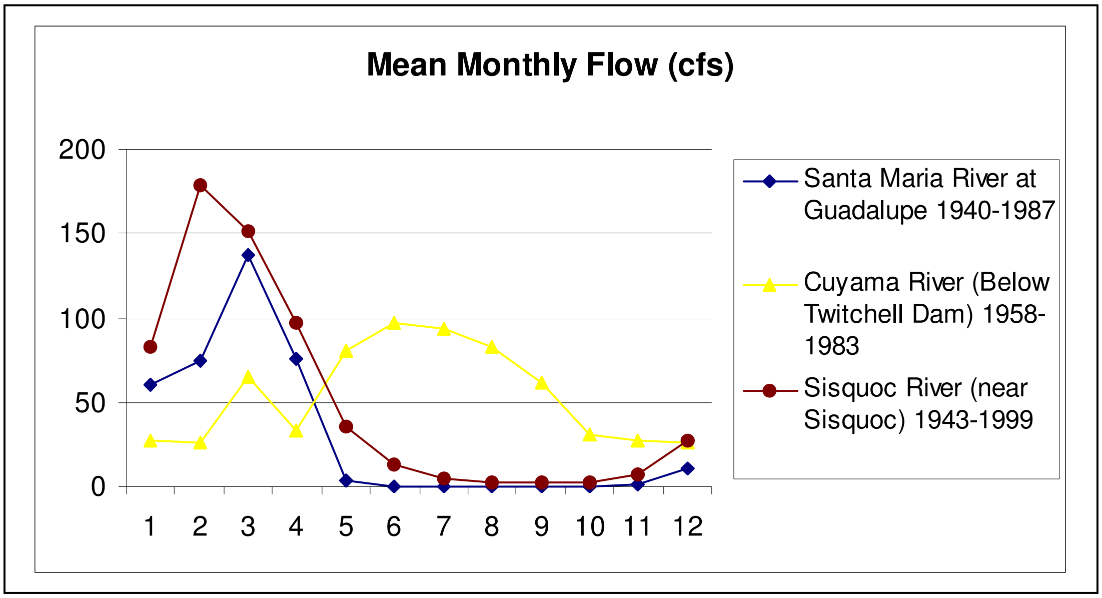

Figure 19. Flow (cfs) in the Santa Maria, Cuyama, and Sisquoc River Watersheds (USGS). Flow (cfs) and Months of the Year are shown.

4.3. Land Use Data

Water Board staff considered the spatial data required for the following purposes to prepare this report: delineation of watershed boundaries; compilation of land use tables; preparation of orientation maps, and presentation of hydrologic and transportation networks. Water Board staff used watershed areas to describe the condition of the watershed and to interpret the relative effects of land use on nitrate and un-ionized ammonia levels. Water Board staff used USGS 30-meter Digital Elevation Models to determine sub-watershed boundaries for the listed water bodies. Water Board staff aggregated Multi-Resolution Land Characterization (MRLC) land use classifications into land use categories.

Water Board staff categorized land use classifications into several land uses. The categories included the following: agricultural (including irrigated lands), urban (including commercial, low density/rural residential) and open space (including rangeland). Staff was unable to differentiate between open space and rangeland with the available data. The classification of pasture/hay included intensively managed lands, rather than that typical of rangeland. As such, this classification was included in agriculture, while grassland (as interpreted to mean rangeland) was included in open space.

Figure 20 displays land uses in the Project Area, and Table 23 displays estimated land uses (acres and percent) by main watersheds and subwatersheds, including listed water bodies. The City of Santa Maria drains to numerous channels prior to entering the Santa Maria River. Water Board staff was unable to differentiate watershed drainage areas of the Main Street Canal from Blosser and Bradley Channels as they are supplied by a network of storm drains many of which are underground; as such, these are combined. Water Board staff estimated the residential area of the Nipomo Mesa that drains through a storm drain conveyance to Oso Flaco Creek.

Open space and agriculture remained the largest land uses despite continued development pressure from population growth. The Sisquoc and Cuyama water bodies were not listed as impaired (shown previously in Figure 1). According to Water Board staff's land use analysis, the Sisquoc and Cuyama watersheds were dominated by open space.

Water Board staff then used these land use classes in an export coefficient model. These are discussed in Section 5.2 Source Analysis.

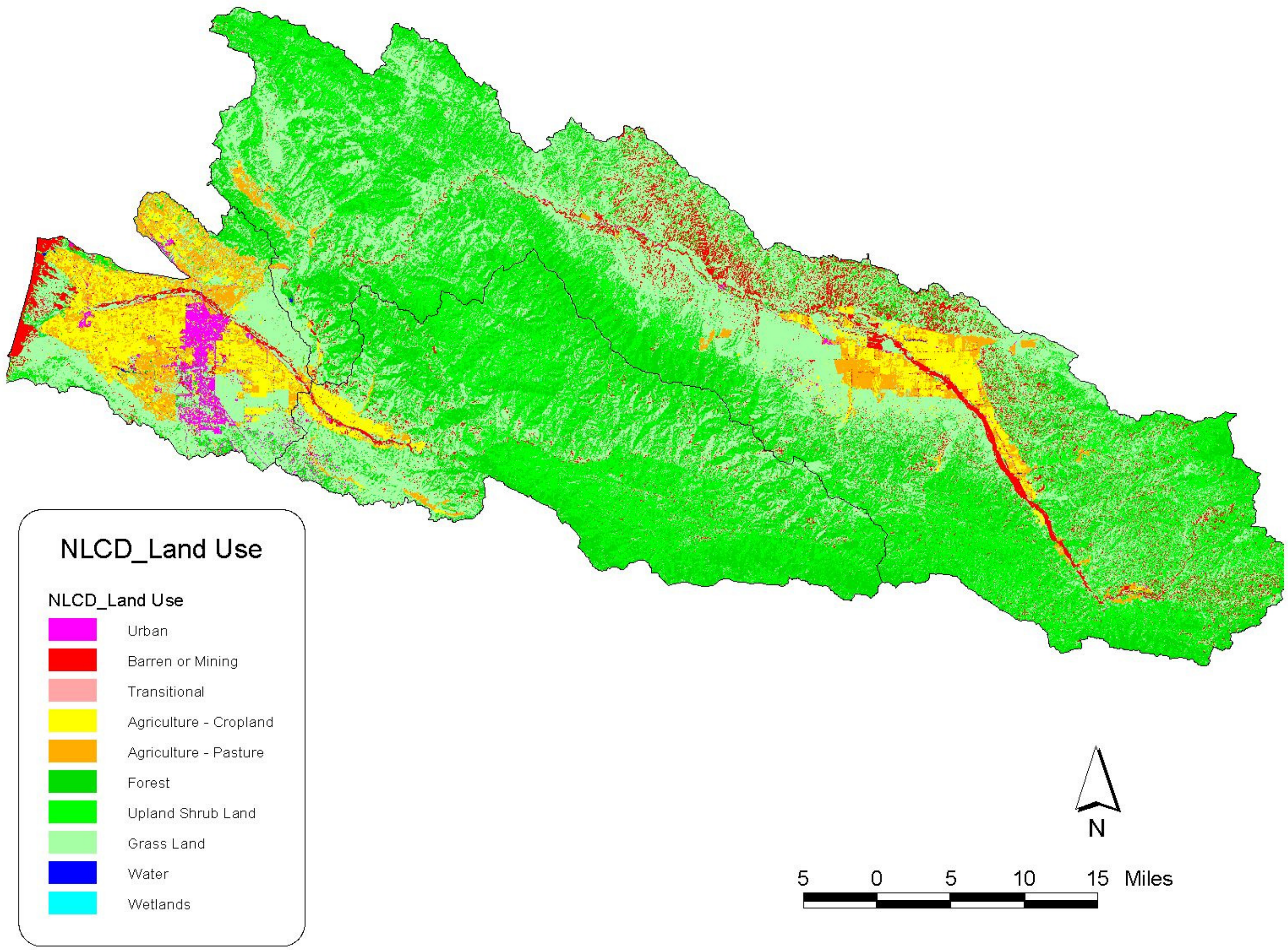

Figure 20. Landuses in the Project Area.

Table 23. Estimated Land Uses (Acres and Percent) in and Loadings to Subwatersheds in the Oso Flaco and Santa Maria Watersheds.

Subwatershed Land Use Areas (acres)

Land Use	Entire Project Area	Sisquoc	Cuyama	Alamo Creek	Santa Maria River	Nipomo Creek	Channels (Blosser,	Bradley Canyon	Orcutt-Solomon	Santa Maria River Mouth	Oso Flaco Creek*
Agriculture	121,324	7,825	36,042	382	19,785	9,369	3,377	4,402	20,980	4	5,980
Open Space	668,169	293,219	636,190	57,413	24,433	4,444	1,267	6,248	31,013	1,160	2,843
Urban	18,255	763	1,155	2	1,253	688	4,692	365	5,576	2	228
Total Area	807,748	301,807	673,386	57,796	45,470	14,501	9,336	11,015	57,569	1,165	9,051
% Area by Subwatershed		37.4	83.4	7.2	5.6	1.8	1.2	1.4	7.1	0.1	1.1

Subwatershed Land Use (%)

Land Use	Entire Project Area	Sisquoc	Cuyama	Alamo Creek	Santa Maria River	Nipomo Creek	Channels (Blosser,	Bradley Canyon	Orcutt-Solomon	Santa Maria River Mouth	Oso Flaco Creek*
Agriculture	15.0	2.6	5.4	0.7	43.5	64.6	36.2	40.0	36.4	0.3	66.1
Open Space	82.7	97.2	94.5	99.3	53.7	30.6	13.6	56.7	53.9	99.5	31.4
Urban	2.3	0.3	0.2	0.0	2.8	4.7	50.3	3.3	9.7	0.2	2.5
Total %	100	100	100	100	100	100	100	100	100	100	100

4.4. Data Analysis Summary

Water Board staff concluded the following from the information presented above:

4.4.1. Seasonality

- The water bodies are characterized by lower dry-season flows than wet-season flows, and lower year-round flows than those found upstream in the Cuyama and Sisquoc Rivers.
- Nitrate concentrations measured at the Main Street Canal, Orcutt-Solomon Creek, Oso Flaco Creek, and Little Oso Flaco Creek were elevated above water quality objectives year round.
- Nitrate concentrations along the Santa Maria River appeared to be higher during the dry season, although exceedances were found during every month of the year.
- Nitrate samples taken by the County of Santa Barbara (Project Clean Water) and by Komex Inc. from Orcutt-Solomon Creek and the Santa Maria River during storm events did not exceed the nitrate water quality objective.
- Un-ionized ammonia concentrations were elevated in the Santa Maria River upstream of the estuary, Bradley Canyon Creek, Blosser Channel, Main Street Canal, Orcutt-Solomon Creek, and Oso Flaco Creek above the general toxicity water quality objectives year-round.

4.4.2. Water Quality Impairment

- Water bodies included on the 303(d) list were impaired as described below (and described previously in Table 2).
- The municipal and domestic supply beneficial use was impaired by nitrate on the following waterbodies: Santa Maria River and Estuary, Bradley Canyon Creek, Bradley Channel, Main Street Canal, Orcutt-Solomon Creek, Oso Flaco Creek and Little Oso Flaco Creek.
- Beneficial uses were impaired by un-ionized ammonia due to exceedances of the general toxicity objective on the following waterbodies: Santa Maria River and Estuary, Bradley Canyon Creek, Bradley Channel, Blosser Channel, Main Street Canal, Orcutt-Solomon Creek, and Oso Flaco Creek.
- Aquatic life Beneficial uses were impaired by nutrients on the following waterbodies: Santa Maria River and Estuary, Bradley Canyon Creek, Bradley Channel, Blosser Channel, Main Street Canal, Orcutt-Solomon Creek, Oso Flaco Creek, Little Oso Flaco Creek, and Oso Flaco Lake.
- Water Board staff considers the most upstream site on Orcutt-Solomon Creek at Black Road (ORB), a low flowing drainage, as not impaired as it exhibited low nitrate and un-ionized ammonia levels year-round.
- Little Oso Flaco Creek is not specifically listed as impaired on the 303(d) list but was impaired for nitrate; Water Board staff will develop a nitrate TMDL for Oso Flaco Creek as well as for Little Oso Flaco Creek.
- Oso Flaco Lake is on the 303(d) list for nitrate due to impairment of the domestic and municipal supply beneficial uses but is not designated as supporting these

uses; staff will not develop a nitrate TMDL for this water body, rather TMDLs protective of aquatic life uses.

- Blosser Channel is not specifically listed as impaired on the 303(d) list but was impaired for un-ionized ammonia; Water Board staff will develop an un-ionized ammonia TMDL for this water body.

4.4.3. Land Use and Sources

- Groundwater nitrate concentrations in the Santa Maria Valley, including groundwater used for agricultural irrigation were elevated above the nitrate water quality objective; groundwater is a source of nutrients to the impaired waterbodies although the extent is uncertain.
- Data indicated that rangeland areas did not contribute significant nutrient levels.
- Nitrate concentrations measured in stormwater runoff from urban areas did not exceed water quality objectives, but may impair aquatic life during storm events.
- Data indicated that stormwater (runoff, private laterals as discussed in the following section) is a source of nutrients to the impaired waterbodies.
- Effluent and groundwater concentrations measured by wastewater treatment plants indicated they are not a source of impairment to the listed waterbodies.
- Nitrate concentrations in stormwater samples taken from the Santa Maria Sanitary Landfill indicated they were not a source of impairment.

5. SOURCE ANALYSIS

The purpose of the Source Analysis is to identify sources and assist in allocating appropriate responsibility for actions needed to reduce loads from these sources. Water Board staff relied on information presented in the *Data Analysis* section and considered the following:

- Monitoring efforts to determine sources of nitrate and un-ionized ammonia,
- Relationships between seasonal conditions and pollutant levels,
- Connections between land use and pollutant concentrations,
- Connections between surface water and groundwater, and
- Uncontrollable, natural sources.

This section provides information on the potential influence of land use activities on nitrate and un-ionized ammonia concentrations and the influence and uncertainty of degraded groundwater on surface waters.

Results of land use and data analyses indicated the primary sources in the project area were runoff from irrigated agriculture and urban lands. Water Board staff determined that in some areas, rural residential properties were also a source of impairment (discussed below in Section 5.2 Sources of Nutrients).

5.1. Potential Influence of Ground Water on Nitrate Concentrations

As discussed previously in Section 4.1, groundwater nitrate concentrations in portions of the Santa Maria River watershed and other subwatersheds were substantially elevated, with numerous sites consistently exceeding the water quality objective. Irrigated agricultural growers often irrigate with groundwater that has elevated nitrate levels. Staff acknowledges some uncertainties in the origins (e.g. fertilizer, sewage, historic dairies) of the elevated nitrate levels throughout the project area. Furthermore, the impacts of the degraded groundwater to the listed water bodies were not fully understood, nor the specific timeframe to achieve groundwater water quality objectives.

As discussed previously in Section 2, upstream of Highway 1, the river is dry for most of the year, flowing intermittently in a braided pattern during and shortly after rainfall events, and during releases from Twitchell Dam[1]. Downstream from Highway 1, shallow surface water is almost always present and riparian vegetation is more prevalent, in some places forming a wide, dense riparian corridor. Flows observed during the dry season upstream of Highway 1 are largely a result of agricultural or urban runoff, and releases from Twitchell Dam that are conducted for the purpose of recharging the Santa Maria groundwater basin. Releases from Twitchell Dam, along with rainfall events, could potentially influence downstream upwelling and instream nutrient levels, but staff was uncertain as to its significance.

Flows observed downstream from Highway 1 during the dry season are due primarily to agricultural and urban runoff, as well as emergence of subsurface channel flow. Some of the monitoring sites, particularly in the lower portions of the watershed, may be located in zones where groundwater discharges to the stream. Staff evaluated seasonal trends and found that while surface water nitrate concentrations in the Santa Maria River appeared to be higher during the dry season, exceedances were found during every month of the year.

Water Board staff is conducting a pilot study as part of the groundwater protection program within the project area. Information produced from this effort will inform staff of the relative contributions of groundwater sources during TMDL implementation and the feasibility of achieving the estimated timeframes for TMDL achievement. This information will benefit staff's understanding of the ground-surface water interface for both TMDL development and/or implementation.

Staff acknowledges that some implementation efforts, such as nutrient management on irrigated agricultural lands (soil testing and adjusting fertilizer nitrogen content) may reduce groundwater nitrate levels. Staff anticipates improvements from these implementation efforts despite uncertainties in quantifying the rate of reductions.

Staff recognized the influence of groundwater on surface water quality and the uncertainty as to its proportional impact and influence on achieving the TMDLs.

5.2. Sources of Nutrients

As discussed previously in Section 4.3, Water Board staff used watershed areas to interpret the relative effects of land use on nutrient loading. Figure 20 displayed land uses in the Project Area, and Table 23 displayed estimated land uses (acres and

1 The purpose of the releases from Twitchell Dam is to recharge the Santa Maria groundwater basin. During dry periods of the year, water is released at a rate to ensure percolation occurs upstream of the Bonita School Road crossing (Santa Maria Valley Water Conservation District).

percent) by main watersheds and subwatersheds, including listed water bodies. Water Board staff then used these land use classes in an export coefficient model. Estimated nitrate and ammonia loading rates are shown in Table 24. Table 25 contains a description of the land use classifications and the nitrate and ammonia export coefficient values that were used to estimate loads. Water Board staff calculated loading based on these export coefficients and land use information for each subwatershed.

Table 24. Estimated Nitrate and Ammonia Loads (lbs/ac/yr) from Subwatersheds in the Santa Maria and Oso Flaco Watersheds.

	Subwatershed Loading (lbs. NH3/yr)										
Land Use	**Entire Project Area**	**Sisquoc**	**Cuyama**	**Alamo Creek**	**Santa Maria River**	**Nipomo Creek**	**Channels (Blosser,**	**Bradley Canyon**	**Orcutt-Solomon**	**Santa Maria River Mouth**	**Oso Flaco Creek***
Agriculture	308,164	19,875	91,546	969	50,253	23,797	8,579	11,180	53,289	10	15,189
Open Space	40,090	17,593	38,171	3,445	1,466	267	76	375	1,861	70	171
Urban	22,819	954	1,443	2	1,566	860	5,865	456	6,970	3	284
Total Load	371,073	38,422	131,160	4,416	53,284	24,924	14,520	12,011	62,120	82	15,644
Load %	100	10.4	35.3	1.2	14.4	6.7	3.9	3.2	16.7	0.0	4.2
Load (lbs TN/ac/yr)	0.5	0.1	0.2	0.1	1.2	1.7	1.6	1.1	1.1	0.1	1.7

Table 25. Land Use Classification and Nitrate Export Coefficient Values (lbs/ac/yr).

MRLC Land Use Description	Aggregated Land Use Class	SCCWRP * Nitrate	SCCWRP * Ammonia
Low Intensity Residential	Urban	5.52	1.25
High Intensity Residential	Urban	5.52	1.25
High Intensity Comm/Ind/Trans	Urban	5.52	1.25
Other Grasses (Urban/Rec; e.g. parks)	Urban	5.52	1.25
Open Water	Open Space	1.44	0.06
Bare Rock/Sand/Clay	Open Space	1.44	0.06
Quarries/Strip Mines/Gravel Pits	Open Space	1.44	0.06
Deciduous Forest	Open Space	1.44	0.06
Evergreen Forest	Open Space	1.44	0.06
Mixed Forest	Open Space	1.44	0.06
Deciduous Shrubland	Open Space	1.44	0.06
Grassland/Herbaceous	Open Space	1.44	0.06
Woody Wetlands	Open Space	1.44	0.06
Emergent Herbaceous Wetlands	Open Space	1.44	0.06
Planted/Cultivated (orch, vines, groves)	Agriculture	15.5	2.54
Row Crops	Agriculture	15.5	2.54
Small Grains	Agriculture	15.5	2.54
Pasture/Hay	Agriculture	15.5	2.54
Bare Soil	Agriculture	15.5	2.54

Notes: * Values (expressed as nitrate fluxes) contained in *Pollutant Mass Emissions to the Coastal Ocean of California: Initial Estimates and Recommendations to Improve Stormwater Emission Estimates*, Appendix C1-11, Southern California Coastal Water Research Project, Nov. 2000.

Water Board staff included the entire watershed area draining to the Santa Maria River in order to consider all of the contributing land uses to the lower watershed. In a loading analysis, Water Board staff concluded certain areas, particularly the Sisquoc and Cuyama subwatersheds, drained large open space areas and were not likely contributing excessive levels of nitrate and un-ionized ammonia. While open space appears to have contributed a large percentage of the load, it is because of the large area of open space. Water Board staff concluded this to be non-controllable and/or insignificant based on previous studies (e.g. National Monitoring Program, 2003). Water Board staff also concluded that the source of the impairment was confined to the lower reaches of the Santa Maria watershed, rather than to the entire watershed.

The Santa Maria River, Orcutt-Solomon Creek, and Oso Flaco Creek watersheds received loading primarily from irrigated agricultural areas. Water Board staff was unable to differentiate the drainage area boundary for the Main Street Canal from Blosser and Bradley Channels as part of the GIS analysis, but was able to determine that both agriculture and urban areas are contributing loads to the impaired water bodies.

Water Board staff could not draw conclusions from the GIS analysis as to the significance or the origin of the sources from rural residential land uses (e.g. manure from farm animals, failing individual septic systems). Water Board staff observed that numerous rural residential properties in the Santa Maria River watershed (e.g. Orcutt-Solomon, Bradley Canyon) contained farm animals.

Additionally, the GIS analysis did not provide information regarding point sources (e.g. WWTPs, refinery operations).

Staff acknowledged that historical land uses that are no longer in operation (e.g. dairies), may have contributed to some groundwater impairment.

Staff recognized the limitations of using export coefficients to estimate loading and as such, used this analysis to provide a context for relative loading, rather than to provide actual load allocations.

Staff concluded the following from the land use analysis:

- The Santa Maria River, Orcutt-Solomon Creek, and Oso Flaco Creek watersheds received nutrient loading primarily from irrigated agricultural areas.
- Low density or rural residential land uses activities (manure from farm animals, failing individual septic systems) contributed to elevated nutrient levels (discussed in the following section).
- Watersheds that were not impaired (e.g. Cuyama and Sisquoc) contained the largest open space (e.g. rangeland, shrub, forest) areas. Water Board staff considered the load from open space as non-controllable.

5.2.1. Irrigated Agricultural Runoff (fertilizer applications)

Irrigated agriculture comprises 15% of the project area, primarily in the lower Santa Maria Valley. As discussed previously in Section 5.1, nitrate concentrations in groundwater were elevated in the Project Area, and growers irrigating with groundwater that contained elevated levels of nutrients contributed to the impairment. Irrigated agriculture in the project area included farming of numerous crops, such as, celery, broccoli, lettuce, and cauliflower. These activities include applying fertilizers that contain nutrients to facilitate healthy plant growth.

Drainage infrastructure for farm tail water runoff was comprised primarily of large ditches, which drained to the listed water bodies. Staff observed surface and tile drains discharging from agricultural fields during multiple field visits in wet and dry seasons. Several data collection efforts discussed in Section 4.1 Water Quality Data Analysis indicated elevated levels of nutrients in agricultural drainages and adjacent to agricultural fields. Staff also found irrigated agriculture operations within the Santa Maria River levee west of Highway 101. Staff concluded applications of fertilizer to land within the river bed were a direct source of nutrients to groundwater and surface water during periods of flow.

Water Board staff concluded that runoff from irrigated agriculture in the Project Area was a source of nutrients to the listed waterbodies. The Water Board regulates irrigated agriculture through the Conditional Waivers of Waste Discharge Requirements for Discharges from Irrigated Lands in the Central Coast Region (conditional waivers). The permit includes requirements for landowners and operators to implement nutrient control measures and irrigation efficiency which will reduce nutrient runoff, and monthly nutrient and flow monitoring.

5.2.2 Urban Runoff

Urban runoff containing fertilizer and irrigation water on private and public landscapes transfers nutrients to surface waterbodies. Staff observed dry season flows in urban storm drains during multiple field visits in 2005 - 2007. Several data collection efforts (see Section 04.1.2. City of Santa Maria Stormwater Monitoring) indicated levels of nutrients in and adjacent to urban areas (e.g. Prell Basin, Hobbs Basin, Nipomo Mesa) that are within water quality objectives, but elevated above criteria recommended for healthy aquatic life.

Included in this source category are private sewer laterals as it is the responsibility of the municipality to prevent waste from entering the storm drain. Lateral pipes that connect private properties to a sanitary sewer collection system (discussed in Section 5.2.5. WDR Permitted Facilities) can leak due to offsets, faulty connections, and/or cracks or chips in the pipes themselves. Sewage can be transferred to stormdrains and surface water through private sewer laterals leaking onto a sidewalk or into a gutter. The discharge can either be carried via stormwater in the wet season, or through other water sources in the dry season. Laterals leaks in proximity of surface waters could reach surface waters during the wet season when the ground becomes saturated or in locations where a conduit of groundwater exists.

Staff concluded that stormwater discharges are a source of nutrients to the listed water bodies.

5.2.3. Domestic Animals (Small Animal Operations)

Nitrate and ammonia sources may include small livestock operations such as those for horses or chickens and other farm animals on rural residences. Manure from small farming and rural residential facilities, if improperly managed, is a potential source as well. According to a Manure Management Survey conducted in Santa Cruz County (Ecology Action, 2006), proper manure management is necessary to prevent nutrient inputs to watersheds and impacts to vegetative habitat and drinking water supplies and other beneficial uses. There also is evidence from other watersheds on the Central Coast (e.g. Morro Bay, Watsonville Sloughs, San Lorenzo River) supporting the conclusion that nutrients from animals such as horses and livestock that are in proximity to a waterbody, travels to the respective waterbody through stormwater runoff.

Staff observed domestic animals (e.g. horses) on rural residential areas adjacent to impaired reaches that were likely discharging waste (e.g. Nipomo Creek, Orcutt-Solomon Creek) during several field visits during both the dry and wet seasons, in March and September 2007.

Properties directly adjacent to impaired waterbodies in the project area, along with improper manure management may be contributing to nitrate and un-ionized ammonia levels. Water Board staff concluded that nutrients from these livestock operations contributed to exceedance of water quality objectives.

5.2.4. Onsite Wastewater Systems

Human sources of nutrients can originate from failing onsite wastewater systems, onsites sewage disposal systems, or septic systems in rural residential areas. Onsite wastewater systems generally provide a safe and effective means of handling domestic sanitation needs in rural areas. However, many onsite wastewater systems are located near water bodies where there is evidence of elevated nutrient levels and may impact beneficial uses of the water bodies. Staff evaluated whether onsite wastewater systems are a source in San Luis Obispo and Santa Barbara Counties.

Staff concluded that onsite sewage disposal systems failures on residences adjacent to impaired water bodies may be a source of nitrates to the listed waterbodies within San Luis Obispo County. To determine whether or not onsite sewage disposal systems were a source, staff evaluated available information as discussed below.

Within San Luis Obispo County, the Nipomo Mesa and the Oso Flaco watershed, some rural residences use onsite wastewater systems to treat domestic wastewater. Sanitary surveys, have not yet been completed in San Luis Obispo County, except for a few locations not in the Project Area. Staff observed numerous rural residences within the Project Area, but did not find direct evidence of specific onsite sewage disposal systems failures. According to San Luis Obispo County (August, 2005), insufficient information was available to determine whether or not all of the onsite wastewater systems on the Nipomo Mesa were functioning properly.

An important factor for an onsite wastewater system to function effectively is sufficient depth of unsaturated soil below the leachfield where filtering and breakdown of wastewater constituents can take place. Without adequate separation distance to the water table, groundwater becomes vulnerable to contamination with wastewater constituents (Questa Engineering Corporation, 2003).

Staff reviewed suitability and potential of a soil type for specific uses, including septic tank absorption fields (Soil Survey, San Luis Obispo County, California Coastal Part, 1984). In the Oso Flaco area, some onsite sewage disposal systems would not function properly due to the water table and poorly drained soils. In some places, depth to groundwater is 10-20 inches (U.S. Department of Agriculture, 1984). In the Nipomo watershed, septic tank absorption fields may not function properly due to slow permeability.

Staff spoke with three business owners of septic tank pumping services in the community. According to these business owners, most onsite sewage disposal system owners did not know how to maintain their system. While they did not note any generalized problem areas, they indicated that individual systems were problematic throughout the project area.

Staff concluded that the onsite wastewater system failures in the Oso Flaco Creek watershed, along with those in the Nipomo Creek watershed, on the Nipomo Mesa, occurred during the time of writing of this report. Staff based this conclusion on multiple lines of indirect evidence discussed above. Staff concluded that onsite wastewater system failures on residences adjacent to impaired water bodies are a source of nutrients to the listed waterbodies within San Luis Obispo County.

Santa Barbara County Environmental Health Services hired Questa Engineering Corporation to conduct the Septic System Sanitary Survey of Santa Barbara County (2003). This effort was a survey and compilation of previously existing information on onsite wastewater systems in the county, not a scientific study to delineate the discharge of pollutants entering ground water that flows into surface water. The survey was not intended to isolate or evaluate the functioning status or impact from individual onsite wastewater systems. The purpose of this survey was to collect and consolidate pertinent data regarding OSDSs, assess the associated impact on public health and water quality, and develop recommendations on ways to address certain types of problems or specific problem areas. The study focused on areas that encompass the heaviest concentrations of onsite wastewater systems and the areas of potentially greatest concern from a public health and water quality perspective. These included several small subdivisions (including Foxenwood Estates and Lake Marie Estates) in the Orcutt-Solomon Creek subwatershed.

The areas evaluated also provided the basis for presenting the full range of conditions and problems that need to be addressed in regard to onsite wastewater system usage throughout Santa Barbara County. The Sanitary Survey included a series of recommendations to address onsite wastewater system problems in Santa Barbara County. Recommendations included various general management measures to be implemented by the County Environmental Health Services to address certain types of problems or situations, as well as more specific measures applicable to the individual Focus Areas examined in the study. Researchers assessed data and evaluated information to identify and prioritize areas for further study of the onsite wastewater systems.

Using the data collected in the study, an overall problem assessment was made for each of the identified septic system Focus Areas, including impacts on both surface water quality and groundwater quality. According to the study, the soils in the Orcutt area were generally moderate to well drained; however, locally, permeability and septic system suitability could be restricted due to accumulation of finer-grained sediments or high water table conditions. Researchers assigned a “low” and “low/medium” rating to the Focus Areas that had many older systems and some localized problems due to restrictive (slowly permeable) subsoils within the Orcutt-Solomon Creek subwatershed, and concluded there was little or no existing or prior evidence of water quality impacts that would implicate septic systems in the Focus Area. Orcutt Creek Sampling stations overlap/supplement Project Clean Water sampling near Foxenwood estates. The Board of Supervisors considered this survey a “planning tool.”

Staff also contacted Santa Barbara County staff to determine if there were any other areas with failing onsite wastewater systems in addition to the Focus Areas within the Project Area. Santa Barbara County staff provided information on numbers of violations and problems with individual septic systems as part of a Voluntary Maintenance Program. County staff concluded that due to the soils, larger parcels, and deeper groundwater, onsite wastewater systems in the other portions of the Project Area were not a problem (D. Brummond, pers. Comm. July 17, 2007).

Staff concluded onsite wastewater systems were a source of nutrients to some of the listed water bodies in San Luis Obispo County (Nipomo Mesa, and Oso Flaco). Staff concluded that failing onsite wastewater systems were not a source of nutrients in Santa Barbara County.

Water Board staff recently updated the Basin Plan criteria for on-site systems, including requiring the development of on-site management plans (which were previously only recommended). Management plans include Sanitary Surveys; as mentioned above, these surveys have not yet been completed in the Project Area. Controlling discharges from failing onsite wastewater systems is discussed in the Implementation Plan.

5.2.5. WDR Permitted Facilities

Several of the sanitary sewer collection systems in the Santa Maria watershed are authorized to discharge treated municipal wastewater to land. Discharge of municipal wastewater to surface water bodies is prohibited. These discharges percolate to groundwater. Staff reviewed effluent and groundwater data in Section 4.1.7. Wastewater Treatment Plant Monitoring, and concluded that treated effluent was not a source of nutrients contributing to the impairment.

The following entities are responsible for operating the sanitary sewer collection systems, within the Santa Maria watershed:

- the City of Santa Maria,
- the City of Guadalupe,
- the Laguna County Sanitation District,
- the Nipomo Community Services District, and
- the Cuyama Community Services District.

Each municipality is responsible for operation of the sanitary sewer systems, or collection systems. Wastewater from collection systems can reach surface waters from sewer line overflows (spills) or leaks. Sanitary sewer overflows are overflows from sanitary sewer systems of domestic wastewater, as well as industrial and commercial wastewater, depending on the pattern of land uses in the area served by the sanitary sewer system.

A proactive approach that requires permit enrollees to ensure a system-wide operation, maintenance, and management plan is in place will reduce the number and frequency of sanitary sewer overflows within the state. Dischargers will be developing collection system management plans during renewal of their permits. To facilitate proper funding and management of sanitary sewer systems, each enrollee must develop and implement a system-specific Sewer System Management Plan. All are required to enroll under statewide general order for collection systems which requires development of management plan by August 2010. Guadalupe has specific requirements in WDR Order No. R3-2005-0015 calling for adoption of a Collection System Management Plan.

Staff provided a status of those wastewater facilities in Spring 2007. The Cuyama permit was being circulated for comment in draft form, and was scheduled for renewal in May 2007. This facility was unlikely to be a source of nutrients. The Nipomo CSD was not scheduled for update, but due to some ongoing operational problems, they were developing a long-range wastewater management plan which will include major upgrades to the facility. The City of Santa Maria is also evaluating upgrades to their facility. The City of Santa Maria will submit with their application for expansion, a groundwater evaluation report describing a) impacts from existing discharge, b) capacity for evaluating such impacts with existing wells, c) anticipated impacts due to expanded capacity (at worst case), and d) treatment needed to assure water quality protection.

Staff reviewed spills reported to CIWQS from 2001 to 2007 for each of the entities listed above. Two spills were reported from the City of Guadalupe and Nipomo Community Services District and none within the Cuyama Community Services District. Staff concluded that spills within the Cuyama Community Services District, City of Guadalupe, and Nipomo Community Services District were not a source.

Spills were reported frequently within two districts: the City of Santa Maria and the Laguna County Sanitation District. Spills within the City of Santa Maria; however, were relatively small (less than 1,500 gallons) with three that discharged to a storm drain or were contained within a Santa Barbara County flood control channel. Staff generally could not determine from the spill reports if the discharge within the storm drain was carried to a surface water. However, there was potential for the spill to travel to a surface water either through stormwater or other water sources. The remainder of spills within the City of Santa Maria were contained on land.

According to City of Santa Maria staff (December, 2006) there may be sewer overflow problems in some residential areas. The City of Santa Maria indicated that they were planning to identify and eliminate as many overflows as possible via video camera logging of the sewer lines. Staff also spoke with City of Santa Maria agency staff in January 2008 regarding the condition of the collection system within the city. City of Santa Maria staff described problems within the public collection system that included, but were not limited to (1) dysfunctional lines in alleys due lack of slope necessary to move effluent, (2) collection system reaches that could not be accessed via road ways, and (3) spills from a public collection system reach discharged into River Oaks Lake, a drainage basin located in the Northeast section of the City of Santa Maria. Water Board staff documented a group of children from an adjacent elementary school visiting the River Oaks Lake on October 16, 2007.

Water Board staff concluded that the City of Santa Maria has made progress in addressing issues including the use of a video camera to detect collection system problems that may lead to the degradation of water quality. However, collection system integrity issues remain that must be addressed.

Water Board staff also found reports of spills from private sewer laterals within the City of Santa Maria. However, from the data reported, staff determined that none of the private sewer lateral spills were discharged to a waterbody.

Numerous spills (public spills and spills from private sewer laterals) occurred within the Laguna County Sanitation District, with one large public spill exceeding 19,000 gallons in

2007. These are identified in Table 26. Despite developing an improved maintenance program in 2007, staff concluded spills within the Laguna County Sanitation District were likely a source of nutrients to the impaired waterbodies.

Staff also reviewed events reported to CIWQS under the new statewide general order per Sanitary Sewer Overflows (SSO) search since May 2007. Spills were reported as occurring within these two districts. Spills within the Laguna County Sanitation District discharged to storm drains. To reiterate from above, there is the potential for sewage to flow or be carried to a surface water once it reaches a storm drain.

Staff concluded that the effluent discharged to land from each of the wastewater treatment plants was not contributing nutrients; however, spills from the Laguna County Sanitation District's Collection System and spills and leaks from the City of Santa Maria Collection System were likely contributing nutrients to surface waters. Staff addresses private sewer laterals in the following section, Municipalities Subject to Storm Water Permits. These are addressed in the Implementation Plan.

Table 26. Number of Spills and Range of Spill Volume within the Laguna Sanitation District.

Year	Number of Spills	Range of Spill Volume (in gallons)	Private Sewer Lateral or Public system spill?	Was a Surface Waterbody Affected?*
2007	6	1,500 – 19,000	Unclear in database; at least two were public system spills	All but one spill were discharged to a storm drain or retention basin.
2006	7	200- 12,000	Public and private	While some reports indicated a surface waterbody was not affected, others indicated spill reached a storm drain.
2005	6	200 – 1,000	Likely all public	One spill was isolated along a curb. All other spills were discharged to a storm drain.
2004	15	200 – 77,000	Public and private	One spill reached Orcutt Creek. One spill reached Orcutt Creek Basin. Six spills reached storm drains. Seven spills did not affect a waterbody.
2003	5	100 – 3,000	Public and private	Two spills discharged to land. One spill flowed to drainage inlet and two to storm drains.
2002	10	100 - 300	Public and private	Two spills were contained within channel cut for effluent irrigation piping and one of those spread to a broccoli field. One spill discharged to land. Three discharged to storm drains and three reports did not indicate the final destination of the spill.
2001	8	180 - 3743	Public and private	One to Orcutt Creek, one to Solomon Creek, three spill discharged to storm drain

* If a spill was carried to a storm drain, staff cannot determine if the spill continued to a surface waterbody or not; however, if a spill flows to a storm drain, staff determined there is potential for the spill to continue to a waterbody.

5.2.5.1 Permitted Facilities and Low Threat Discharges

The Water Board issues Waste Discharge Requirements (WDRs) for several facilities in the Santa Maria and Oso Flaco watersheds. Numerous facilities (e.g. onsite systems for schools, food processing plants) are permitted for discharge to land. These facilities are authorized to discharge treated wastewater to land where such discharges are likely to percolate to groundwater. None of the facilities discharge to surface waters. Staff discussed these facilities and their permit compliance with Water Board permitting staff and concluded that they were not a source of nutrients to impaired waters in the Project Area.

Permitted discharges to surface waters also include water supply discharges, fire hydrant testing, and vegetable cooling (ice melt), none of which are likely sources of nutrients to the listed water bodies. These facilities are enrolled under the General NPDES Permit for Discharges with Low Threat to Water Quality, Fruit and Vegetable Processing Waste, Order No. R3-2004-0066; and fire hydrant testing or flushing; General National Pollutant Discharge Elimination System Permit for Discharges with Low Threat to Water Quality, Order No. R3-2006-0063, NPDES No. CAG 993001.

Staff discussed these facilities and their permit compliance with Water Board permitting staff and concluded that they were not a source of nutrients to impaired waters in the Project Area.

Staff concluded these were not contributing to nutrient levels in the Project Area. Permitted discharges also include industrial facilities under the stormwater program.

5.2.6. Industrial permitted facilities

The Santa Maria Oil Refinery is located on the Nipomo Mesa northeast of Oso Flaco Lake. The Santa Maria Oil Refinery collects groundwater data to ensure that operations do not impact water quality. Water Board staff evaluated available data and concluded that the groundwater nitrate concentrations at the refinery exceeded nitrate water quality objectives. Water Board staff evaluated upgradient and downgradient groundwater data and determined that refinery operations were not likely a source of nitrate nor ammonia to groundwater or to surface water.

Water Board staff evaluated nitrate stormwater data collected at the Santa Maria Sanitary Landfill by the City of Santa Maria. Water Board staff concluded the landfill was not a significant source of nitrate nor ammonia to the Santa Maria River because the runoff did not typically exceed water quality objectives.

Numerous industrial facilities (e.g. fertilizer, food processing plants) are located in the Project Area. In September 2008, Water Board permitting staff inspected industrial facilities to determine if they were discharging nutrients that cause impairments (e.g. elevated ammonia in the Main Street Canal). No discharges were found.

5.2.7. Rangeland

Water quality data indicated nitrate concentrations draining primarily rangeland do not contribute significant loads. Water Board staff collected data that demonstrated nitrate in the creeks did not significantly change when management practices were implemented (National Monitoring Program, 2003). This data suggested that rangeland practices were not a significant source of nitrate, and staff concluded this was likely the same for ammonia.

Water Board staff concluded rangeland was not a significant source of nitrate in the listed water bodies. Water Board staff also concluded ammonia was not likely a source causing impairment to the listed waterbodies.

5.2.8 Natural and Background

Natural sources were a source of nutrients on each of the land uses present in the project area, particularly in riparian areas. Staff concluded this source contributed to nutrients in each of the listed water bodies. Natural sources, however, are uncontrollable, and staff does not propose implementation actions to reduce loading. These background sources alone do not cause impairment of water quality.

5.3. Source Analysis Summary

Water Board staff concluded that the nitrate levels throughout the Santa Maria and Oso Flaco watersheds were elevated and vary by season. Un-ionized ammonia levels were elevated year-round in the impaired water bodies. Data indicated that water and habitat quality impairments occurred from excessive nutrient loading. Monitoring data and a land use analysis confirmed that nitrate and un-ionized ammonia was originating from multiple sources. Water Board staff concluded that the following sources were most likely to contribute to nitrate and un-ionized ammonia impairment of the listed water bodies:

Table 27. Sources of Nutrients to Santa Maria and Oso Flaco Watersheds.

Irrigated Agricultural Runoff (fertilizer applications)
Urban Runoff (fertilizer applications and private sewer laterals)
Failing Onsite Sewage Disposal Systems (septic systems)
Spills and Leaks from Sanitary Sewer Collection Systems • Laguna County Sanitation District • City of Santa Maria
Domestic Animals (small animal operations)
Natural and Background

6. Critical Conditions and Seasonal Variation

Water Board staff determined that there may be a pattern of seasonal variation at some water bodies based on the timing of values exceeding water quality objectives. For example, nutrient concentrations were higher during the dry season in some waterbodies (e.g. the Santa Maria River). However, in these waterbodies samples exceeded water quality objectives during every month of the year.

In most of the waterbodies, exceedances of about the same magnitude occur during all seasons and all locations. Nutrient levels were elevated year-round, and as such allocations and implementation needed to be implemented year-round to resolve impairment rather than based on seasonality.

Staff concluded that there are no critical conditions; therefore, the TMDLs and implementation activities will apply evenly.

Additionally, due to the uncertainties discussed previously, staff concluded the most protective approach is to establish TMDLs, allocations and implementation per critical conditions year-round. Therefore, recommendations for this project apply during all seasons.

7. TMDL Calculation and Allocations

A Total Maximum Daily Load (TMDL) is the loading capacity of a pollutant that a water body can accept while protecting beneficial uses. TMDLs can be expressed as loads (mass of pollutant calculated from concentration multiplied by the volumetric flow rate), but in the case of nitrate or ammonia, it is more logical for the TMDLs to be based only on concentration. TMDLs can be expressed in terms of either mass per time, toxicity or other appropriate measure [40 CFR §130.2(I)]. A TMDL expressed as a concentration is logical for this situation because the risks (e.g. public health, aquatic life) associated with drinking water and/or toxicity are not readily controlled on a mass basis. Therefore, Water Board staff proposes establishing TMDLs expressed as a concentration in the listed water bodies. The TMDLs are the same concentrations as were proposed in the numeric targets section, Section 3.3. The TMDLs apply in all areas of the tributaries. Per the designated beneficial uses in the Basin Plan (Table 1), staff applied the COLD benthic chlorophyll a criteria to the Santa Maria River and Orcutt Solomon Creek and the WARM criteria to Oso Flaco Creek and Oso Flaco Lake.

Staff proposes the following TMDLs to protect the beneficial uses in the project area. These are as follows:

1) The municipal and domestic supply beneficial use is protected by the numeric water quality objective of 10 mg/L-N maximum for nitrate for the following waterbodies:

   a) All reaches of Bradley Canyon Creek
   b) All reaches of Bradley Channel
   c) All reaches of Main Street Canal

d) Santa Maria River and Estuary from (312SMA) to Bull Creek Road (312SBC)
e) Orcutt (Solomon) Creek from the confluence with the Santa Maria River to the most upstream site on Orcutt-Solomon Creek at Black Road (312ORB),
f) All reaches of Oso Flaco Creek
g) All reaches of Little Oso Flaco Creek.

2) The general water quality objective for toxicity includes a maximum concentration of 0.025 mg/L for un-ionized ammonia (NH_3-N) for the following waterbodies:

a) All reaches of Bradley Canyon Creek
b) All reaches of Bradley Channel
c) All reaches of Blosser Channel
d) All reaches of Main Street Canal
e) Santa Maria River and Estuary from (312SMA) to Bull Creek Road (312SBC)
f) Orcutt (Solomon) Creek from the confluence with the Santa Maria River to the most upstream site on Orcutt-Solomon Creek at Black Road (312ORB),
g) All reaches of Oso Flaco Creek

3) Aquatic life is protected by a maximum Benthic Algal Biomass of 150 mg chl-*a*/m^2 for waterbodies supporting COLD beneficial uses for the following waterbodies:

a) Santa Maria River and Estuary from (312SMA) to Bull Creek Road (312SBC)
b) Orcutt (Solomon) Creek from the confluence with the Santa Maria River to the most upstream site on Orcutt-Solomon Creek at Black Road (312ORB),

and

Aquatic life is protected by a maximum Benthic Algal Biomass of 200 mg chl-*a*/m^2 for waterbodies supporting WARM beneficial uses for the following waterbodies:

a) All reaches of Bradley Canyon Creek
b) All reaches of Bradley Channel
c) All reaches of Blosser Channel
d) All reaches of Main Street Canal
e) All reaches of Oso Flaco Creek
f) All reaches of Little Oso Flaco Creek.
g) All reaches of Oso Flaco Lake

4) Aquatic life is protected by a maximum Biostimulatory Risk Index score of 0.40 for the following waterbodies:

a) All reaches of Bradley Canyon Creek
b) All reaches of Bradley Channel
c) All reaches of Blosser Channel

d) All reaches of Main Street Canal
e) Santa Maria River and Estuary from (312SMA) to Bull Creek Road (312SBC)
f) Orcutt (Solomon) Creek from the confluence with the Santa Maria River to the most upstream site on Orcutt-Solomon Creek at Black Road (312ORB),
g) All reaches of Oso Flaco Creek
h) All reaches of Little Oso Flaco Creek.
i) All reaches of Oso Flaco Lake

Water Board staff determined that concentration-based TMDLs were more appropriate than load-based TMDLs because the beneficial uses requiring protection are measured by instream concentrations, rather than accumulated load. While TMDLs are not expressed as loads for this Project, loading data could be valuable during the implementation phase. As such, staff recommends evaluating loading from sources, such as irrigated agriculture, in the Implementation Plan.

The proposed waste-load and load allocations for all *non-natural* sources are equal to the TMDL concentrations and focus on reducing or eliminating the controllable sources of nitrate and ammonia. These sources shall not discharge or release a “load” that will increase the load above the TMDL of the water body. Sources in all areas of the tributaries will be held to these allocations.

Staff relied on existing water quality objectives for nitrate and un-ionized ammonia as shown below. Additionally, staff relied on various nitrate and phosphate values for predicted benthic algal biomass (for cold freshwater – 150 mg chl-*a*/m^2 and warm freshwater – 200 mg chl-*a*/m^2) to protect aquatic life. This conclusion is based on the NNE model results that indicated that either nitrate or phosphate levels could be reduced to meet the predicted WARM and COLD biomass criteria. As such, staff determined that various nutrient levels and canopy coverage could be combined to protect beneficial uses. Reducing phosphate contributions allowed nitrate contributions to be higher, while protecting both the drinking water beneficial use and those for aquatic life. Moreover, specific nutrient concentrations (other than that protective of the municipal drinking water supply for nitrate of 10 mg/L-N) did not need to be established, rather staff identified and quantified TMDLs as aquatic life response targets (Benthic Algal Biomass and Biostimulatory Risk Index Score).

Water Board staff concluded the following allocations are necessary to achieve water quality objectives:

- Load allocations for the waterbodies specified above to owners and operators of irrigated agriculture, small animal operations, and onsite wasterwater systems:
    - a maximum concentration of 10 mg/L for nitrate (as N),
    - a maximum concentration of 0.025 mg/L for un-ionized ammonia (NH_3),
    - a maximum biostimulatory risk index of 0.4, and
    - a maximum benthic algal biomass of 150 mg/m^2 for waterbodies designated as supporting the COLD beneficial use and a maximum of 200 mg/m^2 for waterbodies designated as supporting the WARM beneficial use.

- Waste load allocations for the waterbodies specified above to municipalities for stormwater discharges and sanitary sewer collection systems:
    - a maximum concentration of 10 mg/L for nitrate (as N),
    - a maximum concentration of 0.025 mg/L for un-ionized ammonia (NH_3),
    - a maximum biostimulatory risk index of 0.4, and
    - a maximum benthic algal biomass of 150 mg/m^2 for waterbodies designated as supporting the COLD beneficial use and a maximum of 200 mg/m^2 for waterbodies designated as supporting the WARM beneficial use.

Nitrate levels suitable for municipal drinking water supply may not be protective of aquatic life. As such, Water Board staff evaluated the appropriateness of including allocations for nitrate to meet the general water quality objective for toxicity. Water Board staff also evaluated whether surface water may be affecting the beneficial uses of groundwater. Staff did not propose TMDLs or associated numeric targets and allocations at this time above existing general toxicity and groundwater objectives, largely in part due to lack of known methodology and certainty. This will be re-evaluated every three years following TMDL adoption, and is discussed in the Monitoring Plan.

The allocation to background (including natural sources) is also the TMDL concentrations. The parties responsible for the allocation to controllable sources are not responsible for the allocation to natural sources. Additionally, there are activities and/or facilities that Water Board staff concluded were not sources causing impairment. Water Board staff determined that the existing loads from these activities and/or facilities will not exceed the TMDLs..

Table 28. Allocations to Responsible Parties

Entire Project Area/ Watershed (including tributaries)	Responsible Party and Source	Maximum Nitrate-N (mg/L)	Maximum Un-ionized Ammonia-N (mg/L)	Maximum Biostimulatory Risk Index	Maximum Benthic chlorophyll-a (mg /m2)[1]
WASTE LOAD ALLOCATIONS					
Santa Maria Watershed (Bradley Canyon Creek, Bradley Channel, Blosser Channel, Main Street Canal, Santa Maria River and Estuary)	San Luis and Santa Barbara County and City of Santa Maria (Stormwater) municipalities	10.0	0.025	0.4	COLD – 150 WARM – 200
Santa Maria and Orcutt-Solomon Watersheds (Bradley Canyon Creek, Bradley Channel, Blosser Channel, Main Street Canal, Santa Maria River and Estuary, Orcutt (Solomon) Creek)	Laguna County Sanitation District and City of Santa Maria municipalities (Spills and Leaks from Sanitary Sewer Collection Systems)	10.0	0.025	0.4	COLD – 150 WARM – 200
Santa Maria, Orcutt-Solomon, (Bradley Canyon Creek, Bradley Channel, Blosser Channel, Main Street Canal, Santa Maria River and Estuary, Orcutt (Solomon) Creek) and Oso Flaco Watersheds	NPDES Permittees for Discharges with Low Threat to Water Quality Order Nos. R3-2004-0066 and R3-2006-0063, NPDES No. CAG 993001	10.0	0.025	0.4	COLD – 150 WARM – 200
LOAD ALLOCATIONS					
Santa Maria, Orcutt-Solomon, (Bradley Canyon Creek, Bradley Channel, Blosser Channel, Main Street Canal, Santa Maria River and Estuary, Orcutt (Solomon) Creek) and Oso Flaco Watersheds	Operators or owners of irrigated agricultural properties (fertilizer and irrigation management)	10.0	0.025	0.4	COLD – 150 WARM – 200
Santa Maria, Orcutt-Solomon Nipomo Mesa and Oso Flaco (Bradley Canyon Creek, Bradley Channel, Blosser Channel, Main Street Canal, Santa Maria River and Estuary, Orcutt (Solomon) Creek) and Oso Flaco Watersheds	Operators or owners of rural residential properties (w/small animal operations)	10.0	0.025	0.4	COLD – 150 WARM – 200
Nipomo Mesa and Oso Flaco (Oso Flaco Creek, Little Oso Flaco Creek, and Oso Flaco Lake)	Operators or owners of rural residential properties (w/failing septic systems)	10.0	0.025	0.4	COLD – 150 WARM – 200
Santa Maria, Orcutt-Solomon, and Oso Flaco(Bradley Canyon Creek, Bradley Channel, Blosser Channel, Main Street Canal, Santa Maria River and Estuary, Orcutt (Solomon) Creek) and Oso Flaco Watersheds	Background/Natural Sources (e.g. elevated levels of nitrate in groundwater)	10.0	0.025	0.4	COLD – 150 WARM – 200

- The Waste Load Allocations and Load Allocations for each non-natural (controllable) source are equal to the TMDL.
- Allocations are the same for each party because this is a concentration based TMDL.
- The Allocations to background (uncontrollable) sources are also equal to the TMDL.
- Parties responsible for allocations to controllable sources are not responsible for allocations to background sources.
- The proposed waste-load and load allocations for all *non-natural* sources are equal to the TMDL concentration and focus on reducing or eliminating the controllable sources of nutrients. These sources shall not discharge or release a "load" of nutrients that will increase the load above the loading capacity of the water body. All areas will be held to these allocations.

Permitted discharges to surface waters such as water supply discharges, fire hydrant testing, and vegetable cooling (ice melt) were meeting allocations because these sources were discharging at levels below water quality objectives (numeric targets). These are enrolled under the General NPDES Permit for Discharges with Low Threat to Water Quality:

- Fire hydrant testing or flushing; Order No. R3-2006-0063, NPDES No. CAG 993001
- Fruit and Vegetable Processing Waste, Order No. R3-2004-0066

The allocation to background (including natural sources from birds) is the receiving water nutrient concentrations equal to the TMDL. The parties responsible for the allocation to controllable sources are not responsible for the allocation to natural sources. This is reasonable because data showed levels were below water quality objectives where there were primarily natural sources (birds or other wildlife).

Should all control measures be in place and nitrate and ammonia levels remain high, investigations will take place to determine if the high levels are due to uncontrollable sources. Responsible parties may demonstrate controllable sources of nitrate and ammonia are not contributing to the impairment of water quality objectives in receiving waters. If this is the case, Water Board staff may consider re-evaluating the targets and allocations.

The TMDLs are considered achieved when the allocations assigned to the controllable and natural sources are met, or when the numeric targets are consistently met in all water bodies.

7.1. Timeline, Milestones, and Criteria for Evaluating TMDL Progress

Staff anticipated that the allocations and numeric targets, and therefore the TMDL, will be achieved 30 years from the date of TMDL approval. Staff concluded the timeframe for meeting the nitrate TMDLs of 10 mg/L (as nitrogen) was 16 years, and the timeframe for meeting the remainder of the TMDLs was 30 years. This timeframe was developed in line with the Central Coast Water Boards Vision Goals for 2025*.*

Staff based this determination on elevated nitrate levels in groundwater (a likely nitrate source to impaired surface waters), the uncertainty of the interface between groundwater and surface waters, and the feasibility of achieving the TMDLs. The estimation is also based on the uncertainty of the time required for water quality improvements resulting from management practices to be realized. For example, small Storm Water Management Program permits outline a 5-year schedule for full implementation of management practices (MPs) and activities. In general, stormwater MPs are designed to achieve compliance with water quality standards to the maximum extent practicable through an iterative process. Staff anticipates that the full in-stream positive effect of all the management measures will be realized gradually.

Stakeholders raised concern regarding the feasibility of achieving the TMDLs given the elevated nutrient levels in both surface and groundwater and given the food safety industry's issues regarding various implementing management measures aimed at reducing nutrient loading (e.g. vegetative buffers.) Staff considered these concerns in determining the timeframe. Staff further discusses feasibility in implementing actions and achieving TMDLs in Section 9.5.

Due to the long period of time that staff determined it will take to meet all the TMDLs, staff developed interim milestones. Staff used the maximum (worse case) exceedances of the nitrate and un-ionized ammonia objectives and the more stringent benthic chlorophyll a level (for COLD beneficial uses of 150 mg/m^2) to estimate timeframes; most water bodies would realize improved water and habitat quality much sooner. Moreover, these maximum levels are not to be interpreted as allowable levels. Staff also included criteria, including the Biostimulatory Risk Index for evaluating TMDL progress. Staff itemized these in a Project Transfer Plan in 2008.

Water Board staff aligned this timeframe with three measurable goals as part of the Vision of healthy watersheds. This project aligns with the Water Board's goals:

> **Goal 1: By 2025 80 percent of aquatic habitat is healthy, and the remaining 20 percent exhibits positive trends in key parameters**
>
> **Goal 2: By 2025 80 percent of lands within any watershed will be managed to maintain proper watershed functions, and the remaining 20 percent will exhibit positive trends in key watershed parameters**
>
> **Goal 3: By 2025, 80 percent of groundwater will be clean, and the remaining 20 percent will exhibit positive trends in key parameters**

Additionally, staff developed criteria to base decisions on whether or not progress towards TMDLs and the measurable goals is being made. Staff based this in part on the Central Coast Water Board's vision to protect healthy aquatic habitat. These criteria are as follows:

- Instream nutrient concentrations are decreasing via ambient and follow-up monitoring,
- Groundwater nitrate concentrations are decreasing,

- Enrollment and participation in regulatory programs (stormwater, irrigated agriculture) is increasing,
- Implementation of land management measures as part of programs (stormwater, irrigated agriculture) and related grants (irrigation and nutrient management) to maintain proper watershed functions is increasing,
- Documentation via reporting and inspections, and tracking of implementation shows an increase in on-the ground implementation,
- Healthy aquatic habitat is increasing,
- Instream dissolved oxygen levels (if impaired) are improving,
- Biostimulatory Risk Index, NNE, and other index scores (IPI) are improving, and
- Populations of rare and endangered plants are increasing.

7.2. Margin of Safety

The TMDL requires a margin of safety component that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water (CWA 303(d)(1)(C)). For this project, a margin of safety has been established implicitly through the use of protective numeric targets, which are in this case the water quality objectives for aquatic life beneficial uses.

The TMDLs for the water bodies in this project are the recommended USEPA criteria for benthic algal biomass along with the Water Board's Basin Plan objectives.

The Basin Plan states that, "controllable water quality shall conform to the water quality objectives..." When other conditions cause degradation of water quality beyond the levels or limits established as water quality objectives, controllable conditions shall not cause further degradation of water quality" (Basin Plan, p. III-2). Because the allocation for controllable sources is set at the numeric target, if achieved, these allocations will achieve the water quality objectives in the receiving water. Thus, in this TMDL there is no uncertainty that controlling the load from controlled sources will positively affect water quality by reducing the nutrient contribution. And while it is controllable water quality conditions ("actions or circumstances resulting from man's activities" (Basin Plan, p. III-2)) that must conform to water quality objectives, receiving water quality will contain discharge from both controllable and natural sources.

Reporting and monitoring will indicate whether the allocations from controllable sources are met, thereby minimizing any uncertainty about the impacts of loads on the water quality.

8. LINKAGE ANALYSIS

The goal of the linkage analysis is to establish a link between pollutant loads and water quality. This, in turn, supports that the loading capacity specified in the TMDL will result in attaining the numeric targets.

As discussed, staff is proposing concentration-based TMDLs, and associated numeric targets and allocations for nitrate and unionized ammonia. The Basin Plan contains numeric values for nitrate and unionized ammonia to protect municipal and domestic supply beneficial uses and to protect aquatic life from toxicity. The linkage is established by the use of concentration-based TMDLs.

Staff is also proposing TMDLs, and associated numeric targets and allocations for biostimulatory risk and benthic algal biomass to protect aquatic life beneficial uses.

Based on studies conducted by Tetra Tech that evaluated the use of nutrient levels as a predictor of benthic algae, staff determined that benthic algal biomass was a better indicator of healthy aquatic habitat. The linkage between the numeric targets and existing nutrient concentrations is provided by the existing and projected nutrient levels and canopy coverage, and predicted benthic algal biomass. Staff concluded that healthy aquatic habitat is represented by recommended WARM and COLD benthic algal biomass criteria

The linkage is also established by the Biostimulatory Risk Index as it simultaneously considers factors which serve as stimuli (nutrient concentrations), in parallel with those which act as in-stream responders (pH, dissolved oxygen, algal and plant cover, water column chlorophyll concentrations).

Staff applied the NNE methodology and biostimulatory risk index to protect freshwater aquatic wetland plants as it was appropriate for the protection of the biostimulatory substances objective. Staff will review this application and use additional methods as they become available. This is included in the Monitoring Plan.

9. IMPLEMENTATION PLAN

9.1. Introduction

The purpose of a TMDL Implementation Plan (Plan) is to describe the steps necessary to reduce loads and achieve the TMDLs. The Implementation Plan identifies the following: 1) actions expected to reduce nutrient loading; 2) parties responsible for taking these actions; 3) regulatory mechanisms by which the Water Board will assure these actions are taken; 4) reporting and evaluation requirements that will indicate progress toward completing the actions; and 5) a timeline for initiation and completion of implementation actions and Water Board staff actions. A monitoring plan designed to measure progress toward water quality goals is included in the following section.

Implementation actions and monitoring requirements rely on existing and proposed regulatory mechanisms. The Implementation Plan incorporates requirements that currently exist pursuant to an existing regulatory mechanism (e.g. permit or prohibition). The Water Board's Executive Officer is authorized to take the proposed steps to insure implementation of appropriate actions to reduce nutrient loading according to the requirements that currently exist. Other proposed actions (e.g. prohibitions of waste discharged from livestock) establish new requirements that must be approved by the Central Coast Water Board, State Water Resources Control Board and California's Office of Administrative Law.

Water Board staff held a CEQA meeting to identify environmental impacts and provided project status in February 2007. In general, the management measures that will be implemented will not adversely impact beneficial uses. Staff will confirm this finding as the project development proceeds and CEQA scoping is completed.

9.2. Building on Existing Efforts

Water Board staff recognized numerous existing efforts and regulatory mechanisms aimed at reducing nutrient loading. These included, but were not limited to the following: rural landowners maintaining individual sewage disposal systems and implementing management measures to control livestock wastes, growers implementing fertilizer and irrigation management measures, and municipalities implementing stormwater management measures. Staff identified possible implementation actions or alternatives for all sources (e.g. stormwater, agriculture) that may be contributing to the impairment. Actions that address nutrient reductions from nonpoint sources must be consistent with the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (SWRCB, 2004).

9.2.1. Southern SLO and SB Counties Agricultural Watershed Coalition

The Southern San Luis Obispo County and Santa Barbara County Agricultural Watershed Coalition acts as a point person/facilitator for diverse interests related to issues that affect agricultural water quality such as TMDLs, assists individual growers with Conditional Agricultural Waiver and other regulatory compliance, and work with other organizations to provide water quality education and outreach.

9.2.2. Cachuma Resource Conservation District Report

The CRCD summarized water quality issues in the Santa Maria River in the Santa Maria River Watershed Non-Point Source Pollution Management Plan (CRCD, 2000). This report focused on non-point source pollution including nutrients, and also provided an overview of methods to address water quality degradation and improvement for agricultural and urban uses, and ecological functions. Also included in the CRCD's report was an assessment of the effectiveness, feasibility, and landowner willingness to implement measures to improve water quality, availability of funding sources, and a summary of local, State and Federal permit and California Environmental Quality Act (CEQA) requirements.

9.2.3. Santa Maria Estuary Enhancement and Management Plan

The State Coastal Conservancy prepared the Santa Maria Estuary Enhancement and Management Plan (Plan) in March 2004. The Plan identified existing conditions of, and stresses to, the natural resources, recommended enhancement or management measures, suggested alternative land use practices; and developed a comprehensive monitoring program to allow for adaptive resource management and plan element modification over time. The actions described by the Plan were developed with stakeholder input, including interested private landowners and project area lessees, with the understanding that implementation would be voluntary.

The Plan acknowledged the benefits of advanced planning and implementation of water quality improvement measures prior to regulatory requirements associated with future TMDLs. The Plan also identified actions (agricultural practices, urban stormwater runoff, water quality monitoring) to be considered for the TMDL implementation plan. Plan development included agricultural outreach interviews (conducted by the Dunes Center) to gather information on cultivated agricultural and cattle grazing practices.

9.2.4. Integrated Regional Watershed Management Plans

In 2007, the Santa Barbara Integrated Regional Watershed Management Plan (IRWMP) outlined a strategic approach that was used to link region-wide and watershed-specific issues with the need for specific projects. One of the projects identified was the Santa Maria River/Oso Flaco, Santa Ynez River, and South Coast Beaches TMDLs Watershed Working Groups sponsored by the Southern SLO and Santa Barbara Counties Ag Watershed Coalition. This project was identified to create a collaborative approach to solve a specific set of problems as well enable disparate interests to formally chart a strategic course.

In July 2007, the San Luis Obispo County amended their IRWMP that was originally adopted in December 2005. The IRWMP includes numerous objectives, including to support the development and implementation of TMDLs to 1) protect and improve water quality and 2) protect and enhance natural resources. The IRWMP includes strategies in the Project Area, including improving wastewater quality (primarily salts) from the Nipomo CSD's Southland Wastewater Treatment Facility into Nipomo Groundwater Basin and Nipomo Creek.

Stakeholders recommended various implementation measures to achieve the TMDLs at a Water Board CEQA meeting and stakeholder update in February 2007 and during follow-up phone conversations with staff. These were as follows:

- Stakeholder groups to strategize watershed-wide management measures
- Installation of treatment wetlands
- Well head protection.
- Irrigation and nutrient management on rural, agriculture, and urban.
- Wastewater management
- Nutrient management program, including a nutrient budget, or balance of ground and surface water infiltration, including all landuses (urban, agriculture, rural).
- Alternate irrigation source (from ground to surface water)
- Irrigation and nutrient management
- Fertilizer storage
- Septic system maintenance
- Manure management
- Grazing management
- Habitat (riparian corridor) restoration
- Public education and outreach

Staff discusses actions be developed or modified as part of TMDL implementation to address nutrient loading in the following section.

9.3. Implementation Actions

The following proposed actions are necessary for the water bodies to achieve the TMDLs. Actions are presented associated with the corresponding source.

9.3.1 Irrigated Agricultural Runoff

The Water Board regulates irrigated agriculture through the Conditional Waivers of Waste Discharge Requirements for Discharges from Irrigated Lands in the Central Coast Region (conditional waivers). The conditional waiver includes requirements for landowners and operators to implement nutrient control measures and monitoring. No additional requirements will be included as part of the implementation plan. Staff will review monitoring data and other reporting requirements (e.g. checklist surveys, inspection information) during triennial evaluations.

In 2007, stakeholders identified the importance of providing nutrient load data, and translating concentrations into loads for the purposes of management practice implementation. Staff recommends this be carried out in implementation as part of a collaborative effort with agricultural representatives.

In 2008, Water Board staff identified irrigation and nutrient efficiency as a top priority for grant funding. Based on the success and lessons learned from a previous irrigation and nutrient management grant, staff determined that three elements were necessary for a successful irrigation and nutrient management program. These were as follows: 1) watershed coordinators, 2) mobile irrigation lab services, and 3) agronomists and nutrient and irrigation advisors. Water Board staff were further developing the program during the time of writing of this report. Staff anticipates that this program will control nutrient discharges from irrigated agricultural lands.

9.3.2 Urban Runoff - Storm Drain Discharges to Municipally Owned and Operated Storm Sewer Systems Required to be Covered by an NPDES Permit (MS4s)

The State Water Resources Control Board adopted a National Pollution Discharge Elimination Permits (NPDES) General Permit for stormwater discharge. The Water Board will be regulating storm water discharges through adoption of Storm Water Management Plans that comply with the NPDES General Municipal Separate Storm Sewer System (MS4) Permit. The General Permit requires smaller state municipal dischargers, such as the Counties of Santa Barbara and San Luis Obispo, and the City of Santa Maria, to develop and implement a Storm Water Management Program (SWMP) that has been approved by the Water Board. The goal of the SWMP is to reduce pollutant discharge through stormwater to the maximum extent practicable.

The SWMPs must specify what management practices the municipality will use to address certain program areas. The program areas include public education and outreach; public involvement and participation; illicit discharge detection and elimination; construction and post-construction stormwater runoff management; and good housekeeping for municipal operations.

The County of Santa Barbara and the County of San Luis Obispo recently obtained general permit coverage (NPDES Permit No. CAS000004, Order No. 2003-0005-DWQ). The City of Santa Maria has submitted a draft SWMP, but has not yet obtained permit coverage. The City of Santa Maria is expected to be enrolled in September 2008.

Several unincorporated areas of the watersheds will be covered in the Counties' permits. The County of San Luis Obispo permit will include the Nipomo Mesa and "old town" Nipomo. The County of Santa Barbara permit will include Orcutt.

The City of Guadalupe drains to the Santa Maria River, but will not be covered by the first five-year term of the MS4 permit. While the urban areas of Guadalupe will not be covered by the MS4 permit, this community is directly adjacent to the Santa Maria River. As such, staff concluded that the municipality should implement similar management measures to prevent nutrient discharges to the Santa Maria River.

The General Permit requires the dischargers to develop and implement a SWMP that includes nutrient fertilizer management measures and private sewer laterals. Staff concluded the Agencies must identify the specific sources that contribute nutrients to surface waters. The Agencies shall identify and implement appropriate management measures to address these sources. The Agencies must develop and implement enforceable means of reducing nutrient loading to stormwater. For example, the SWMP should include public participation and outreach management measures, including mechanisms for reaching specific target source groups.

To address the TMDL wasteload allocations, the Central Coast Water Board will require the municipalities to specifically target nutrients in urban runoff through incorporation of a Wasteload Allocation Attainment Plan in its SWMP.

The Central Coast Water Board will expect the Wasteload Allocation Attainment Plan to be a thorough plan designed to guide the implementation of activities that will achieve TMDL wasteload allocations. The expected principle components of the Wasteload Allocation Attainment Plans are outlined below.

1. A detailed description of a strategy that will be used to guide BMP selection, assessment, and implementation, to ensure that BMPs implemented will be effective at abating pollutant sources, reducing pollutant discharges, and achieving TMDL wasteload allocations.
2. Identification of sources of the impairment within the municipality's jurisdiction, including specific information on various source locations and their magnitude within the jurisdiction.
3. Prioritization of sources within the jurisdiction, based on suspected contribution to the impairment, ability to control the source, and other pertinent factors.
4. Identification of BMPs that will address the sources of impairing pollutants and reduce the discharge of impairing pollutants.
5. Prioritization of BMPs, based on suspected effectiveness at abating sources and reducing impairing pollutant discharges, as well as other pertinent factors.
6. Identification of BMPs to be implemented, including an implementation schedule. For each BMP, identify any milestones to be used for tracking implementation, as well as any measurable goals to be used to assess implementation efforts. Expected BMP implementation for the future implementation years should be included to the extent possible, with the understanding that future BMP implementation plans may change as new information is obtained.[2]

[2] Municipalities currently implementing programs to attain wasteload allocations are encouraged to build upon existing BMPs, milestones, and time-schedules.

7. An analysis exhibiting the connection between BMP implementation and TMDL wasteload allocation attainment, based on the expected wasteload reductions attributable to the BMPs to be implemented.
8. A detailed description of a monitoring program to be implemented to assess discharge and receiving water quality and BMP effectiveness, including a schedule for implementation of the monitoring program. At a minimum, the water quality monitoring program should be consistent with any monitoring program information included in the TMDL documentation.
9. A detailed description of how BMP and plan effectiveness will be assessed. The description should incorporate the assessment methods described in the California Stormwater Quality Association's *Municipal Stormwater Program Effectiveness Assessment Guide*.
10. A detailed description of how the plan will be modified to improve upon BMPs determined to be ineffective during the effectiveness assessment.
11. A detailed description of information to be included in annual reports.[3]
12. A detailed description of how the municipality will collaborate with other agencies, stakeholders, and the public to develop and implement the Wasteload Allocation Attainment Plan.
13. Any other items identified by TMDL Project Reports or Resolutions or currently being implemented to address TMDL provisions.

Following approval of these TMDLs by the Office of Administrative Law, the Central Coast Water Board will require the Wasteload Allocation Attainment Plan to be submitted and incorporated into the SWMP at one of the following milestones, whichever occurs first:

1. Within one year of approval of the TMDLs by the OAL;
2. When a Storm Water Management Plan is submitted for Central Coast Water Board approval;
3. When the storm water annual report is due; or
4. When required by any other Water Board-issued storm water requirements (e.g., when the Phase II Municipal Storm Water Permit is renewed).

Recommended Stormwater Pollution Prevention Measures
Staff developed the following general recommendations for measures:

1) Agencies develop and implement low impact development principles (including increase of pervious surfaces) and practices for new and redevelopment to minimize and prevent the addition of new sources of stormwater runoff.

2) Individuals use preventative management measures such as:

1. Implement fertilizer and irrigation water management on private and public landscapes,
2. Eliminate over watering and runoff of irrigation water into the street,
3. Eliminate leaks in subsurface private sewer laterals through replacement,

[3] Wasteload Allocation Attainment Plans, annual reports, and related documents are expected to be used by Water Board staff to assess TMDL implementation (e.g., TMDL Triennial Reviews).

3) Agencies use management measures such as:

1. Vegetative buffers;
2. Periodic storm drain clean-outs and maintenance;
3. Maintain a street sweeping program to help prevent nutrients from reaching storm drains.

Staff encouraged the agencies to include such measures in the SWMPs to be presented to the Water Board for approval based on the findings in this TMDL implementation plan. If these measures are not included in the approved SWMP, the implementation plan for this TMDL will include requirements and a timeline for such measures to be incorporated into the SWMP and annual reporting to insure TMDL compliance.

The Executive Officer or the Central Coast Water Board will require information that demonstrates implementation of the actions described above, pursuant to applicable sections of the California Water Code and/or pursuant to authorities provided in the General Permit for storm water discharges.

The City of Santa Maria and the Counties of Santa Barbara and San Luis Obispo will be required to report annually on the status of implementation of measures to control nutrients in stormwater. If the City of Santa Maria is not enrolled in the General permit by the time the TMDL is implemented, the Central Coast Water Board will require actions described above pursuant to applicable sections of the California Water Code.

Water Board staff will review annual reports from the Agencies and assess if management practices were implemented and measurable goals were attained. If Water Board staff determines the permittee's actions were unsatisfactory, the Water Board will initiate and complete standard enforcement protocol to require permit compliance.

9.3.3 Sanitary Sewer Collection Systems

Staff concluded that the effluent discharged to land from each of the wastewater treatment plants was not contributing nutrients; however, spills from the Laguna County Sanitation District's Collection System may be contributing nutrients to Orcutt-Solomon Creek, and spills and leaks from the City of Santa Maria Collection System may be contributing nutrients to waterbodies that drain to the Santa Maria River. The Laguna County Sanitation District and City of Santa Maria have Collection System Management Plans and Sewer System Management Plans.

A proactive approach that requires permit enrollees to ensure a system-wide operation, maintenance, and management plan is in place, and will reduce the number and frequency of sanitary sewer overflows within the state. Dischargers will be developing collection system management plans during renewal of their permits. To facilitate proper funding and management of sanitary sewer systems, each enrollee must develop and implement a system-specific Sewer System Management Plan. All are required to enroll under statewide general order for collection systems which requires development of management plan by August 2010. Guadalupe has specific requirements in WDR Order No. R3-2005-0015 calling for adoption of a Collection System Management Plan.

Staff will rely on the existing WDRs and associated reporting to ensure that they implement an improved maintenance program, including spill response to address the spills and discharges to Orcutt-Solomon Creek and to waterbodies that drain to the Santa Maria River.

Staff addressed leaks and spills from private sewer laterals in Section 9.3.2 Urban Runoff.

9.3.4 Domestic Animals (Small Animal Operations)

Staff concluded that livestock (small animal operations) on rural residential properties contributed nutrients to the impaired water bodies. Owners and operators of livestock (small animal operations) on rural residential properties must comply with State's *Nonpoint Source Implementation and Enforcement Policy*. Staff is proposing that landowners whose land supports livestock develop and implement strategies to eliminate nutrient loading from these sources. Staff will propose a watershed prohibition or waiver for these waterbodies. To be in compliance with the prohibition or waiver, six months after receipt of formal notification, property owners must either submit a Nonpoint Source Pollution Control Implementation Program to the Water Board Executive Officer for approval or demonstrate that land activities do not cause waste to pass into waters of the state. The Nonpoint Source Pollution Control Implementation Program must be consistent with Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program. Staff will work with landowners and/or cooperating entities to develop documentation details for such a program during outreach.

The *Nonpoint Source Implementation and Enforcement Policy*, adopted as state law in August 2004, requires the Regional Water Boards to regulate all nonpoint sources (NPS) of pollution using the administrative permitting authorities provided by the Porter-Cologne Act. Nonpoint source dischargers must comply with Waste Discharge Requirements (WDRs), waivers of WDRs, or Basin Plan Prohibitions by participating in the development and implementation of Nonpoint Source Pollution Control Implementation Programs. NPS dischargers can comply either individually or collectively as participants in third-party coalitions. (The "third-party" Programs are restricted to entities that are not actual discharges under Regional Water Board permitting and enforcement jurisdiction. These may include Non-Governmental Organizations, citizen groups, industry groups, Watershed coalitions, government agencies, or any mix of the above.) All Programs must meet the requirements of the following five key elements described in the NPS Implementation and Enforcement Policy. Each Program must be endorsed or approved by the Water Board or the Executive Officer (where the Water Board has delegated authority to the Executive Officer).

Key Element 1: A Nonpoint Source Pollution Control Implementation Program's ultimate purpose must be explicitly stated and at a minimum address NPS pollution control in a manner that achieves and maintains water quality objectives.

Key Element 2: The Program shall include a description of the management practices (MPs) and other program elements dischargers expect to implement, along with an evaluation program that ensures proper implementation and verification.

Key Element 3: The Program shall include a time schedule and quantifiable milestones, should the Regional Water Board require these.

Key Element 4: The Program shall include sufficient feedback mechanisms so that the Regional Water Board, dischargers, and the public can determine if the implementation program is achieving its stated purpose(s), or whether additional or different MPs or other actions are required (See Section 12, Monitoring Program).

Key Element 5: Each Regional Water Board shall make clear, in advance, the potential consequences for failure to achieve a Program'*s* objectives, emphasizing that it is the responsibility of individual dischargers to take all necessary implementation actions to meet water quality requirements.

9.3.5 Failing Onsite Wastewater Systems

Staff concluded that failing septic systems in certain locations within the Project Area in San Luis Obispo County is a source of nutrients to the listed water bodies.

The Water Board regulates all discharges that affect the quality of the water of the state, including those from individual sewage treatment systems. However, the Water Board encourages direct regulation of these waste discharges by authorized and qualified local agencies where such regulation is mutually beneficial. The responsibility to oversee construction, inspection, and maintenance of septic systems lies with the local health agencies (e.g. the County of San Luis Obispo) throughout the project area. Water Board staff spoke with San Luis Obispo County and Santa Barbara County staff and evaluated information regarding existing efforts to regulate septic systems.

Water Board staff spoke with agency staff and evaluated information regarding existing efforts to regulate onsite sewage disposal systems, and determined that additional information (e.g. regarding inspections and maintenance) is needed to address potentially leaking and or failing systems. Despite some uncertainty as to the magnitude of the problem and locations of specific failing onsite sewage disposal systems, staff concluded that failing onsite sewage disposal systems could not be ruled out as a source of nutrients.

The Water Board regulates all discharges that affect the quality of the water of the state, including those from onsite sewage disposal systems. However, the Water Board encourages direct regulation of these waste discharges by authorized and qualified local agencies where such regulation is mutually beneficial. The responsibility to oversee construction, inspection, and maintenance of septic systems lies with the local health agencies (e.g. the County of San Luis Obispo) throughout the project area.

Revised Region-wide Basin Plan Criteria

In May 2008, Water Board staff updated the Basin Plan criteria for onsite sewage disposal systems. The revised criteria included requiring development of on-site management plans (which are currently only recommended) including sanitary surveys.

The proposed action updated and revised existing Basin Plan criteria for siting, design, management and maintenance of onsite wastewater systems.

The Basin Plan previously recommended that permitting agencies prepare and implement wastewater management plans. However, only one county within the Central Coast Region has developed an approved onsite wastewater management plan since the recommendation was incorporated into the Basin Plan in 1983. The new criteria require development and implementation of onsite management plans to investigate and mitigate existing and potential future water quality issues resulting from continued use of onsite systems.

State law requires submittal of a report of waste discharge (application) and issuance of waste discharge requirements (permits) by the Water Board prior to discharging waste, such as that from an onsite wastewater system (California Water Code Sections 13260 & 13264). Water Code Section 13269 allows the Water Board to waive these regulatory provisions provided such waivers do not exceed five years, are consistent with applicable state or regional water quality control plans, and are in the public interest. Historically, the Water Board entered into a Memorandum of Understanding (MOU) with permitting agencies to implement the Basin Plan criteria and comply with state law. Until 2004, the MOUs served as waivers of Water Board permits for onsite systems. However, all such waivers expired in 2004, leaving onsite systems subject to individual permitting (a cumbersome and redundant oversight). The Water Board will consider adopting a policy for waiving individual permit requirements for onsite systems sited, designed, managed and maintained in a manner consistent with Basin Plan criteria. Application and enrollment under the waiver will be required for onsite systems in areas not covered by onsite wastewater management plans. Applicants seeking enrollment in this waiver will be required to comply with Basin Plan criteria, submit enrollment fee, and comply with the local jurisdiction's onsite management program (once it is developed). In areas covered by onsite wastewater management plans, which also implements an authorizing MOU with the Central Coast Water Board, the waiver will authorize discharge without direct Water Board oversight. Provided conditions of the onsite management plan and MOU are met, these dischargers need not submit applications to the Central Coast Water Board, pay fees, or receive waiver enrollment notification. They would simply work directly with their local jurisdiction (County or City). The proposed onsite waiver policy will be implemented through updated MOUs to ensure consistent implementation of the Basin Plan criteria for onsite systems. Water Board staff believe that this approach (MOUs and waivers) will be most effective in protecting water quality from onsite system impacts in a streamlined fashion (without duplicative agency oversight).

In 2007, Water Board staff drafted a MOU that designated Santa Barbara County as a local agency qualified and authorized to regulate onsite sewage treatment system siting, permitting, construction inspection, monitoring, and performance requirements. Included in the MOU is the requirement that Santa Barbara County establish a County Ordinance that complies with or exceeds statewide minimum standards, the Central Coast Basin Plan (Basin Plan), and guidelines adopted thereto governing onsite sewage treatment system siting, permitting, construction inspection, monitoring, and performance requirements within the County of Santa Barbara and is at least equal to waste discharge requirements that the Central Coast Water Board would establish. The local agency is responsible for implementing the Code.

It is the joint goal of the Central Coast Water Board and the local agency to protect water quality and public health. This MOU defines cooperative roles for the local agency and the Central Coast Water Board with respect to compliance with the purpose and intent of statewide minimum standards, the Basin Plan, and applicable local ordinances and regulations governing onsite sewage treatment systems. This MOU is intended to assist in creation of a partnership between the Central Coast Water Board and local agency to protect water quality and public health in areas where onsite sewage treatment systems are utilized. The MOUs regarding onsite sewage system management are the implementation required for compliance with the Basin Plan.

9.4. Evaluation of Implementation Progress

Water Board staff will conduct a review of implementation actions and will conduct triennial reviews of all reports and water quality information for progress towards achieving the TMDL. Water Board staff will use annual reports, NPS Pollution Control Implementation Programs, as well as other available information, to review water quality data, implementation efforts, and overall progress toward achieving the allocations and the numeric target.

Water Board staff may conclude that ongoing implementation efforts are insufficient to ultimately achieve the allocations and numeric targets. If staff makes this determination, staff will recommend that additional reporting, monitoring, or implementation efforts be required either through approval by the Executive Officer (e.g. pursuant to Section 13267 or Section 13383 of the California Water Code) or by the Water Board (e.g. through revisions of existing permits and/or a Basin Plan Amendment). Staff may conclude that at the time of review they expect implementation efforts to result in achieving the allocations/numeric target and anticipated implementation efforts should continue. Water Board reviews will continue until the TMDL is achieved.

Responsible implementing parties will monitor according to the proposed monitoring plan (see Section 10) for at least three years, at which time Water Board staff will determine the need for continuing or otherwise modifying the monitoring requirements.

If after 30 years the TMDL is not achieved and controllable sources of nutrients are not contributing to exceedance of water quality objectives in receiving waters, staff will consider modifying numeric targets and/or allocations.

9.5. Feasibility of achieving TMDLs

Staff evaluated the level of management measure implementation to determine the feasibility of attaining the TMDLs. The TMDLs in the Santa Maria and Oso Flaco will rely heavily on growers implementing and reporting on management practices on irrigated agricultural lands. Discharges from irrigated lands to surface and ground water are regulated in the Central Coast Region by the Conditional Wavier for Discharges from Irrigated Lands (conditional waiver), Order No. R3-2004-0117. The Central Coast Regional Water Quality Control Board (Water Board) adopted the conditional waiver on July 9, 2004, for a five-year cycle. Upon enrollment, growers are required to submit a management practice checklist (checklist). In addition, growers must submit an update of the checklist at least once during the five-year cycle of the conditional waiver. The checklist is a short questionnaire that allows growers to identify planned or implemented farm water quality management practices.

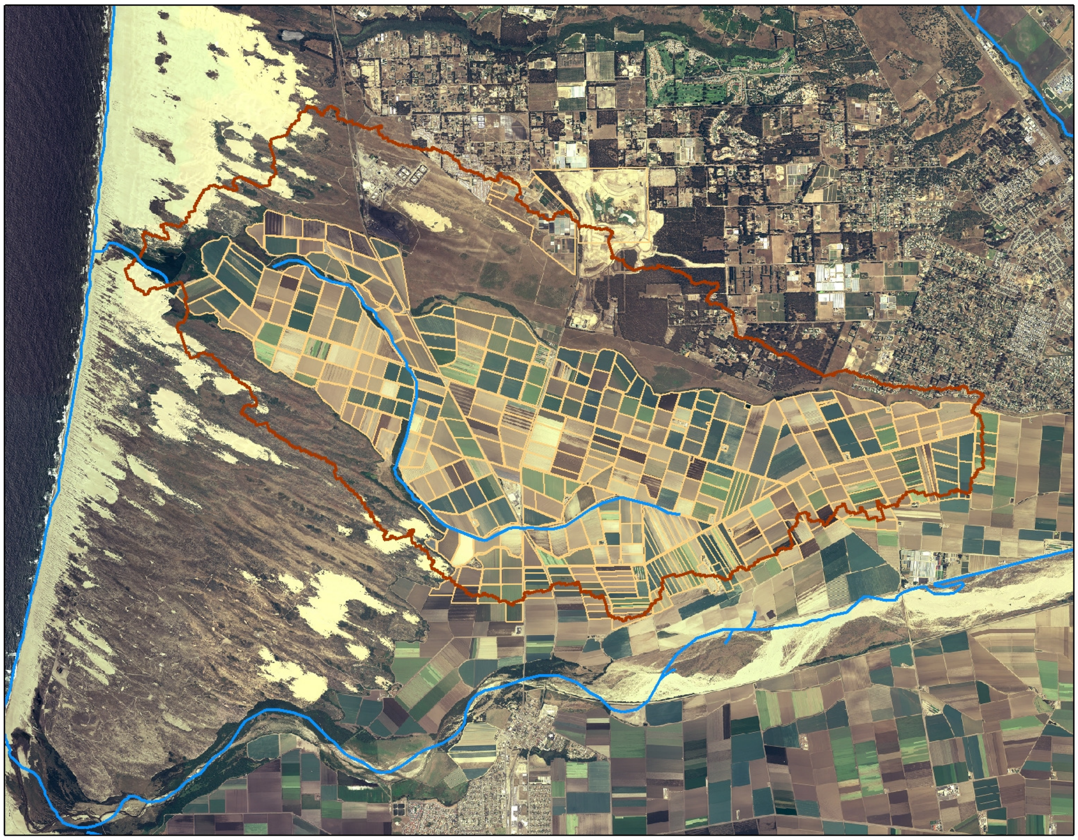

Figure 25. Agricultural Lands in the Oso Flaco Watershed.

Staff evaluated the 2006 Management Practice Checklist Update Report (2006). The purpose of this report was to summarize water quality management practice implementation reported by irrigated commercial farming operations (growers) in the Central Coast Region. Staff evaluated region-wide responses to three questions most related to nutrient management and irrigation water management.

The questions and notable results were as follows:

- **Do you test irrigation water for nitrogen content and incorporate that information into your fertilization program?**

Results showed that growers representing 78.1% of all irrigated crop types region-wide, tested irrigation water for nitrogen content and information is incorporated into fertilization program.

- **Are vegetative buffers implemented between cropped areas, along the lower edge of the farm, and along roadways?**

Growers representing 41.9% acres region-wide implemented vegetative buffers between cropped areas, along the lower edge of the farm, and along roadways, and an additional 13.4% planned implementation within three years. Growers representing 24.2% did not plan to implement this practice.

Staff also evaluated responses from growers in the Oso Flaco watershed to determine whether implementing management measures would achieve the TMDLs, as this area comprises almost entirely irrigated agricultural lands. Staff found that growers representing 94% of the acres in the Oso Flaco watershed were enrolled in the conditional waiver program. Growers reported that 91% tested irrigation water for nitrogen content and incorporated that information into their fertilization program. Growers representing 7% of the acres in the Oso Flaco watershed implemented vegetative buffers between cropped areas, along the lower edge of the farm, and along roadways, and 47% were not planning to implement this practice.

This data suggested that while growers are not installing vegetative buffers, growers are reducing nitrogen in their irrigation water. Staff concluded that the high level of implementation of fertilizer source control would help reduce nutrient loading to the water bodies in the Oso Flaco watershed, increasing the feasibility of attaining the TMDLs. Implementation of vegetative buffers would further reduce nutrient loading to the impaired water bodies. Staff suspects that the low level of implementation of vegetative buffers may be in response to food safety restrictions.

9.6. Adaptive management of habitat protection

Water quality in the Oso Flaco watershed did not meet water quality objectives and was classified as having impaired bodies of water. Stakeholders expressed concern and staff agreed that it would be very difficult to achieve the water quality that is protective of the endangered plants in this watershed as well as its ecosystem. Staff understood that the process of attaining the necessary water quality levels may place a hardship on stakeholders in the watershed. State and federal agency requirements was to ensure the survival and recovery of the endangered plants in the Lake and staff's desire was to work stakeholders to find ways of improving the water quality while protecting the livelihood of stakeholders in the valley.

Possible options to balance the costs to stakeholders in the watershed and habitat protection downstream, staff considered included interim standards, review of management practices, nutrient removal wetlands, and interim habitat management around the endangered plants at Oso Flaco Lake. Only listed species received protection under Federal law; however, other sensitive species were considered in the planning process in the event they become listed or proposed for listing prior to project completion. The USFWS recommended that staff review information in the California Department of Fish and Game's (CDFG) Natural Diversity Data Base.

9.7. CEQA Alternatives Analysis

Water Board staff held a California Environmental Quality Act (CEQA) scoping meeting to identify alternatives environmental impacts, and public workshop to discuss development of TMDLs and Implementation Plans for the control of discharges of nitrates and un-ionized ammonia in February 2007. At the meeting, participants discussed the impacts and feasibility of an expanded scope that included nutrient impacts to aquatic life.

This meeting and workshop provided participants with: 1) an explanation and understanding of the TMDL projects under development, 2) an opportunity to comment on the Project, and 3) an opportunity to comment on the appropriate scope and content of the environmental analysis and environmental documentation for these projects to be prepared pursuant to the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.) and the Water Board's certified regulatory program for basin planning (California Code of Regulations, Title 14, Section 15251, subdivision (g); and Title 23, Section 3775 et seq).

Interested persons were specifically requested to provide information about:

- How they or responsible parties would foreseeably comply with the TMDL;
- The reasonably foreseeable significant environmental impacts associated with those means of compliance;
- Specific evidence supporting that such impacts are reasonably foreseeable, and describing the magnitude (how significant) of the impacts;
- Reasonable alternative means of compliance that would have less significant adverse environmental impacts;
- Reasonable mitigation measures that would minimize any unavoidable significant adverse environmental impacts associated with the means of compliance.

The Water Board is required to undergo a certified regulatory process, by identifying adverse impacts to the environment in a subsequent environmental document. To facilitate a discussion at the scoping meeting to best identify all impacts, Water Board staff identified some potential environmental impacts from various foreseeable methods of compliance (management measures). Stakeholders discussed numerous alternatives (including a no project alternative) along with the environmental impacts of each. These are discussed below.

9.7.1 <u>Alternatives</u>

Staff developed alternatives based on input from stakeholders. These were as follows:

1. No Action (No TMDL)
2. Delay TMDL (until after studies regarding ground/surface water interactions,
3. "Nitrate" TMDL only (to address impacts to drinking water)
   nutrient impairments)
4. TMDL with more restrictive targets
5. Alternative waste load and load allocations:
   a. Other wasteload and load allocations (one responsible party)
   b. Relative load allocations (load-based contributions)
   c. Equal load allocations (same load assigned to each responsible party)
   d. Allocations as equal concentrations
   e. Allocations geographically (by subwatershed)

   f. Allocations based on feasibility
   g. Allocations using water quality trading
6. Proposed Project (TMDL)

Staff evaluated the environmental impacts from implementing various foreseeable methods of compliance required as part of the proposed project, along with those of the alternatives.

9.7.2. Overall environmental impacts of alternatives

Staff summarized environmental impacts raised by stakeholders in February 2007 as follows:

1. Reduced flow and water quality as a result of irrigation management, resulting in less aquatic habitat

2. Increase in groundwater concentrations

3. Conversion of land use (from agricultural to urban) because of economic pressures, and resulting secondary impacts (traffic, air quality)

9.7.3. Environmental impacts from no action (no TMDL)

Existing and future efforts by municipalities and owners and operators of irrigated lands to comply with existing stormwater requirements and the Conditional Waiver (implementation of fertilizer and irrigation management measures) may be sufficient to achieve the TMDL.

There are currently no formal requirements of rural landowners regarding livestock to achieve the TMDLs. This would result in no additional reductions from rural residential lands (septic systems and livestock operations). The environmental impacts from implementing additional activities or various foreseeable methods of compliance are identified below for these lands.

9.7.4. Environmental impacts of delaying TMDL

The environmental impacts of delaying the TMDL are that water and habitat quality may be degraded further, and improvements will take longer to be realized.

9.7.5. Environmental impacts of adopting a nitrate-only TMDL

The environmental impacts of adopting a nitrate-only TMDL to protect the beneficial uses of drinking water are primarily to aquatic life and habitat.

9.7.6. Environmental impacts from stricter numeric targets

Staff evaluated the impacts from stricter nutrient targets, and determined that while specifying actual nutrient values would not cause environmental impacts, this was not necessary as the proposed targets are protective.

9.7.7. Environmental impacts from alternative waste and load allocations

Water Board staff could require *only* urban or *only* agriculture to reduce loading. This alternative; however, would not achieve the TMDLs as reductions are needed from both.

Furthermore, these lands are regulated under existing programs. Additionally, because the environmental impacts from implementing methods of compliance are insignificant, this alternative would also result in insignificant impacts.

Water Quality Trading

Water quality trading is an innovative approach to achieve water quality goals more efficiently. Trading is based on the fact that sources in a watershed can face very different costs to control the same pollutant. While trading can take many different forms, the foundations of trading are that a water quality goal is established and that sources within the watershed have significantly different costs to achieve comparable levels of pollution control (http://www.epa.gov/OWOW/watershed/trading.htm).

Where watershed circumstances favor trading, it can be a powerful tool for achieving pollutant reductions faster and at lower cost. Water quality trading will not work everywhere, however. Trading works best when:

1) there is a "driver" that motivates facilities to seek pollutant reductions, usually a Total Maximum Daily Load (TMDL) or a more stringent water quality-based requirement in an NPDES permit;

2) sources within the watershed have significantly different costs to control the pollutant of concern;

3) the necessary levels of pollutant reduction are not so large that all sources in the watershed must reduce as much as possible to achieve the total reduction needed – in this case there may not be enough surplus reductions to sell or purchase; and

4) watershed stakeholders and the state regulatory agency are willing to try an innovative approach and engage in trading design and implementation issues.

Staff reviewed the above information and an MOU to implement habitat trading to determine whether this would be feasible in the Project Area. Staff evaluated the circumstances in the Oso Flaco and Santa Maria watersheds and determined that Water Quality Trading, while a promising program, would not be feasible in the watershed because the costs of implementing management measures are similar and loads from each source need to be reduced. Staff encourages stakeholders to consider this during later implementation as it could become an effective strategy.

9.7.8. Environmental Impacts from the Proposed Project

The environmental impacts of various foreseeable methods of compliance from urban areas (education and outreach regarding fertilizer reduction/management on landscapes, planting of drought-tolerant species, use of pervious surfaces, water conservation, etc…) are insignificant. The environmental impacts of various foreseeable methods of compliance from agricultural areas (nutrient-reduction management, irrigation water quality testing, irrigation efficiency, contour cropping, cover-cropping, etc…) are insignificant. The environmental impacts of various foreseeable methods of compliance from low density, or rural residential areas (septic tank maintenance, connection to sewer-system, manure management from livestock, etc…) are insignificant. Connection to a sewer-system and/or construction of a future system would cause significant temporary impacts.

9.7.9. Cumulative Impacts

Staff evaluated cumulative impacts of proposed actions including the following:

- food safety,
- voluntary standards, and
- other existing regulations.

Staff determined that the cumulative impacts were not significant.

Staff will further conduct a feasibility analysis of economic and any additional environmental factors should be considered.

9.8 Economic Considerations

Overview

Porter-Cologne requires that the Central Coast Water Board take "economic considerations", into account when requiring pollution control requirements (Public Resources Code, Section 21159 (a)(3)(c)). The Central Coast Water Board must analyze what methods are available to achieve compliance and the costs of those methods."

Staff identified a variety of costs associated with implementation of these TMDLs. Costs fall into four broad categories: 1) planning or program development actions (e.g., establishing nonpoint source implementation programs, conducting assessments, etc.); 2) implementation of management practices for permanent to semi-permanent features; and 3) TMDL inspections/monitoring; and 4) reporting costs.

Anticipating costs with any accuracy is challenging for several reasons. Many of the actions, such as review and revision of policies and ordinances by a governmental agency, could incur no significant costs beyond the program budgets of those agencies. However, other actions, such as establishing nonpoint source implementation programs and establishing assessment workplans carry discrete costs. Cost estimates are further complicated by the fact that some implementation actions are necessitated by other regulatory requirements (e.g., Phase II Storm water) or are actions anticipated regardless of TMDL adoption. Therefore assigning all of these costs to TMDL implementation would be inaccurate.

Cost Estimates

Irrigated Agricultural Runoff (fertilizer applications)

Implementation: All irrigated agricultural activities including nutrient management, specified in the conditional waiver are currently required under the existing Water Board requirements. Water Board staff estimate no significant costs beyond that which is already required.

Inspections/Monitoring: These costs are currently required by the existing Central Coast Water Board conditional waiver.

Reporting: These costs are currently required by Central Coast Water Board conditional waiver.

Storm Drain Discharges

The State Water Resources Control Board adopted an NPDES General Permit for stormwater discharge. The General Permit requires smaller State municipal dischargers, such as the City of Santa Maria and the County of San Luis Obispo and Santa Barbara, to develop and implement a Storm Water Management Program (SWMP). As of the date of writing this report, the Counties have approved SWMP, and the City of Santa Maria has submitted a draft in preparation of the Water Board's approval in late 2008. The Water Board has not approved a Storm Water Management Program for the City of Santa Maria.

Planning or Program Development Actions: Water Board staff estimate no significant costs beyond the local agency program budget.

Stormwater Plan Implementation: To implement the requirements of the TMDL, the Central Coast Water Board may ask local agencies to develop additional management measures for pathogen reduction; identify measurable goals and time schedules for implementation; develop a monitoring program; and assign responsibility for each task. The specifics of the stormwater program efforts will not be known until Central Coast Water Board adoption of the SWMP occurs. Costs of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

The University of South California conducted a survey of NPDES Phase I Stormwater Costs in 2005 (Center for Sustainable Cities, University of Southern California, 2005). They determined the annual cost per California household ranged from $18 to $46. However, these costs were just to keep the existing plan running and did not include start-up costs which may increase the total cost per household. According to Central Coast Water Board Stormwater Unit staff, recently approved Phase II SWMPs in Region 3 ranged from $21 to $130 per household. Stormwater Unit staff reported that the wide range of costs in both cases was based on many factors including the amount of revenue generated by the municipality, the size of the area covered by the SWMP, and because some municipalities did not include the cost of programs such as street sweeping that are already accounted for in other program budgets, while other municipalities did include this cost.

The agencies mentioned above are required to develop and implement a stormwater program for this Watershed independently of the Basin Plan amendment. Since this is an existing requirement under Phase II of the storm water program, no additional cost is estimated for implementing the existing storm water management program.

Inspections/Monitoring: Water Board staff is proposing the above Agencies monitor storm drains. The purpose of the monitoring is to determine the effectiveness of management measures. (The Water Board will not impose targets/allocations as effluent limits on an Agency.)

Water Board staff estimated monitoring will cost local agencies approximately $1,500 per year ($60/sample x 5 samples/sampling event x 5 sampling events per year).

Reporting: The City of Santa Maria and the Counties of San Luis Obispo and Santa Barbara are required to report independent of the TMDL under Phase II of the municipal storm water program. Therefore, no costs have been estimated for reporting.

Storm Drain Discharges-Private Lateral Upgrade Required by Central Coast Water Board Adopted SWMP

As of the date of writing this TMDL project report, SWMPs did not include a program to prevent leaking private sewer laterals from contributing to pathogen loading to urban runoff. Therefore, inspecting private sewer laterals and repairing private sewer lateral leaks is a new cost.

Inspections/Monitoring: According to the Proposition 13 Report, the cost to test for leaking private lateral is approximately $1,000

Private Lateral Upgrade Implementation: This TMDL project report requires the City of Santa Maria and the County of San Luis Obispo and Santa Barbara to develop measures to prevent leaking private sewer laterals from impacting urban runoff and stormwater flows. According to the Proposition 13 Report, the cost to repair a leaking private lateral is estimated to be $5,000.

Reporting: The County of San Luis Obispo and Santa Barbara are required to report independent of the TMDL under Phase II of the municipal storm water program. Therefore, no costs have been estimated for reporting.

<u>Onsite Wastewater System Discharges</u>

Onsite Wastewater Disposal System Plan Implementation: As of the date of writing this report, staff recommended a new basin plan criteria as well as a Human Waste Discharger Prohibition be developed. The costs of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

Inspections/Monitoring: The costs of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

Reporting: The costs of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

Sanitary Sewer Collection System Spills and Leaks

Implementation: All sanitary sewer activities including spill response, specified in the Basin Plan amendment are currently required under the existing Water Board permits and requirements. Water Board staff estimate no significant costs beyond the local agency program budget.

Inspections/Monitoring: These costs are currently required by Central Coast Water Board permits.

Reporting: These costs are currently required by Central Coast Water Board permits.

Domestic Animals (Small Animal Operations)

Planning or Program Development Actions: The cost to develop nutrient control measures at these facilities will vary from site to site depending upon constraints present at each site. Water Board staff estimate approximately eight hours is necessary for planning control actions.

Farm Animals/Livestock Plan Implementation: There are a variety of methods owners of farm animals/livestock can use to help control wastes. Some methods include installing livestock exclusion barriers, stables for horses, corrals, and manure bunkers at locations that prevent runoff from entering surface waters.

1. Livestock Exclusion Barriers: According to USEPA, the cost of permanently excluding livestock from areas where animal waste can impact surface waters ranges from $2,474/mi to $4,015/mi (*Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. 840-B-92-002,* United States Environmental Protection Agency, January 1993).

2. Horse Stables: Horses can be boarded at stables. According to the American Miniature Horse Association, miniature horses can be board in a professional stable for $50 to $150 per month per horse and full size horses can be boarded for $200 to $550 per month per horse. The cost depends on the facilities, pasture, and riding opportunities (http://www.amha.com/MarketTools/Profitibility.html).

3. Corral Cost: According to a Progressive Farmer website, a corral (excluding the head gate) can cost less than $7,000. Gates cost the most-between $3,000 and $4,000 (http://www.progressivefarmer.com/farmer/animals/article/0,24672,1113452,00.html).

4. Manure Bunker Costs: Ecology Action has worked with landowners to install manure bunkers. Manure bunkers help prevent stormwaters from infiltrating the manure thereby causing runoff of pollutants from the manure. According to Ecology Action, the average cost for constructing a manure bunker on properties in the San Lorenzo watershed was approximately $4000. (Each bunker was constructed on an existing cement slab, or a new one was poured and employed some type of cover - either a permanent roof or a tarp.) The cost of bunker construction varies greatly depending on the size and materials choice. When looking at bunkers for the entire program, costs ranged from $3000 to $15,000 (Reference: E-mail dated 5-1-2007 from Jennifer Harrison of Ecology Action).

Inspections/Monitoring: The landowner cost for inspections/monitoring will vary depending upon the elements of the Nonpoint Source Implementation Program. The cost could be low if daily property walks occur to assess and repair discharges. Costs are higher if a landowner performs water quality monitoring.

Reporting: Water Board staff estimate it would take approximately eight hours of land owner time to prepare a report to the Water Board. This report is required every three years.

Cost Summary

These costs are reasonable relative to the water quality benefits to be derived from the adopting these TMDLs.

The total cost of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

10. MONITORING PLAN

10.1. Introduction

The Monitoring Plan outlines the monitoring sites, frequency of monitoring, and parties responsible for monitoring. This Monitoring Plan recommends sites and frequency, etc and requires parties to propose monitoring acceptable to the Executive Officer of the Water Board based on the recommendations. The monitoring for TMDL compliance and evaluation is the minimum staff concludes is necessary. These locations will be used to determine if the TMDL and allocations are met. If a change in these requirements is warranted after the TMDL is approved, the Executive Officer and/or the Water Board will require such changes. Although Water Board staff does not require daily samples to be collected, the samples required shall be sufficient to represent a daily load.

10.2. Monitoring Sites, Frequency, and Responsible Parties

Water Board staff recommended existing monthly nutrient and flow monitoring in receiving waters at the following locations as part of the CMP and CCAMP programs:

1. Oso Flaco Creek (312OFC, 312OFN, 312BSR);
2. Oso Flaco Lake (312OFL) and Little Oso Flaco Lake;
3. Cuyama River (312CCC, 312CUY);
4. Alamo Creek (312ALA);
5. Nipomo Creek (312NIT; NIP);
6. Bradley Canyon Creek (312BCF);
7. Santa Maria River (312 SMA; 312SMI, 312GVS, 312MSS, 312MSD); and
8. Orcutt-Solomon Creek (312 ORC, 312ORI, 312ORB).

The above monitoring may be done in concert with the CMP and Water Board's CCAMP existing five-year rotational monitoring in the project area. Landowners and operators of activities discharging nutrients may participate individually or cooperatively as part of the existing conditional waiver program to conduct monthly monitoring.

In addition to the receiving water locations, staff also proposes monitoring in stormwater at the following locations:

1. Bradley Channel
2. Blosser Channel
3. Main Street Canal
4. Three existing stormwater monitoring sites, based on City of Santa Maria's existing monitoring and recommendations to characterize urban runoff.

Samples should be taken during three storm events and during two dry season flows (when present). Staff also recommended parties monitor within the Santa Maria Estuary.

Staff received input from stakeholders and recommended that macroinvertebrates be monitored as part of the Monitoring Plan.

Staff received input from USFWS and recommended the following studies to analyze the effects of nutrients in Oso Flaco Lake and Oso Flaco Creek to avoid and/or minimize adverse affects to the endangered species in Oso Flaco Lake. These are as follows:

a. Sediment studies:

   i. nutrient concentrations throughout depth profile

   ii. sediment loading/accretion rates

b. Relative contributions of groundwater versus surface water runoff to Oso Flaco Lake inflow

c. Survey of historical aerial imagery of Oso Flaco Lake:

   i. changes over time to shoreline location

   ii. changes over time to shoreline, emergent, or aquatic plant cover, community makeup, and abundance

Staff recommended the following modifications to the wastewater treatment plant MRPs:

1. Modify frequency of effluent and groundwater monitoring so facilities are consistent (e.g. quarterly for effluent and semi-annually for groundwater). Monitoring frequency is normally based upon threat to water quality and variability of the discharge. From this standpoint, monitoring at Cuyama is likely to be less frequent that the City of Santa Maria (due to less flow and less potential threat to water quality). Staff will look at each facility on a case-by-case basis, and recommend specific requirements in the Final Report.

2. Add nitrate as N to facilities that are only testing for nitrate and nitrite in effluent.

3. Add un-ionized ammonia to effluent monitoring for the facilities that are just monitoring total ammonia.

4. Request data electronically in a format that CCAMP, and consistent with CIWQS.

Staff recommends the following changes to the City of Santa Maria stormwater MRP:

- Add pH and temperature field measurements so that staff can calculate un-ionized ammonia values.

Staff recommends collecting benthic algal density data in the Monitoring Plan, at sites in Oso Flaco Creek and the Santa Maria River, along with Oso Flaco Lake and the Santa Maria River Estuary to determine if further reductions in upstream water bodies are necessary. Staff also recommends performing habitat assessments of sensitive freshwater wetland plants in the Project Area, including Oso Flaco Creek and Lake.

As part of each three year review, staff recommends evaluating and comparing predicted benthic chlorophyll a levels and Biostimulatory Risk Index scores at impaired and non-impaired sites.

Water Board staff also recommends evaluating the available methodology and evidence for evaluating impairment and determining criteria for protecting the beneficial uses of groundwater and nitrate toxicity. Staff recommends reevaluating during the three year reviews following TMDL adoption.

Staff recognized the influence of groundwater on surface water quality, and the uncertainty as to the significance in amount and impact on achieving the TMDLs. Staff recommends evaluating any new information during each three year review.

If Water Board staff determines that further monitoring efforts are necessary to determine relative contribution of sources, then Water Board staff will contact landowners, implementing parties, and/or cooperating entities. Additionally, if the executive officer determines additional monitoring is needed, he shall request it pursuant to Section 13267 of the California Water Code.

10.3. Reporting

The parties responsible for implementation and monitoring may incorporate the results of monitoring efforts in reports filed pursuant to the conditional waiver, Small MS4 Stormwater Permit or other correspondence as requested by the Water Board pursuant to California Water Code Section 13267.

If reporting changes become necessary based on staff's assessment of the TMDL implementation progress, the Executive Officer or the Water Board will require such changes. At a minimum, the Water Board will evaluate monitoring reporting data and implementation reporting information every three years.

11. PUBLIC PARTICIPATION

In 2006, Water Board staff began developing a Stakeholder Plan for this project. Water Board staff anticipated a low-medium to medium level stakeholder involvement, as identified in the Process for Addressing Impaired Waters in California (June 2005). Water Board staff based this determination on the fact that there are few competing interests; committed, formal stakeholder groups; local implementation and monitoring; and adequate time in the schedule. Opportunities for interested party involvement include: providing data and other information to Water Board staff, and providing review and comment on the Preliminary Project Report, Draft Report, Final Project Report, and Regulatory Action Plan (i.e. Basin Plan Amendments).

The primary framework for stakeholder involvement to date has been communication via email and telephone, Water Board staff participation in an existing group's meetings (e.g. farm water quality short-course) and focused meetings to request specific information (e.g. water quality data) or to answer specific questions (e.g. regarding implementation approaches).

On September 30, 2004, Water Board staff provided an update of proposed TMDLs to the Farm Water Quality Short Course. On March 28, 2006 Water Board staff met with agricultural community members to better inform the Southern San Luis Obispo County Agricultural Watershed Coalition regarding TMDL development and implementation options.

Water Board staff emailed a status to numerous stakeholders, and has had informal correspondence with several key stakeholders in the counties. Water Board staff provided another update during a face-to-face meeting with growers on August 29, 2006.

Water Board staff held a CEQA meeting to identify environmental impacts and provide project status in February 2007. Water Board staff notified stakeholders to communicate project status, expectations, request input and gain any additional relevant information; and answer any questions. Water Board staff requested review and comments on the Preliminary Project Report as to whether the data analyses for the TMDL components include all available data and information and support the conclusions drawn, along with input and ideas on implementation strategies. Water Board staff incorporated these comments into this Report. Water Board staff will then circulate this document for stakeholder and scientific peer review in 2008.

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APPENDIX A CENTRAL COAST AMBIENT MONITORING PROGRAM DATA

SiteTag	DateTime	Unionized Ammonia	NO3_N	OP_P
312ALA	1/11/2000 13:30			
312ALA	2/1/2000 14:30	0.001789		
312ALA	2/1/2000 14:30		0.21573	0.0561
312ALA	2/1/2000 14:30			
312ALA	2/15/2000 13:30	0.001562		
312ALA	2/15/2000 13:30		0.051685	0.0495
312ALA	2/15/2000 13:30			
312ALA	2/29/2000 14:30		1.017977	0.0429
312ALA	4/13/2000 12:12	-0.00238	0.2	0.0099
312ALA	5/1/2000 11:30	-0.00412	0.2	-0.001
312ALA	6/6/2000 13:06	-0.00731	0.1	0.03
312ALA	6/29/2000 11:30	-0.0039	0.1	0.04
312ALA	8/1/2000 11:40	-0.00048	0.152809	0.0462
312ALA	8/2/2000 3:45			
312ALA	9/7/2000 9:10		0.224719	0.0627
312ALA	9/8/2000 6:10			
312ALA	10/5/2000 13:15	0.003187	0.119101	0.066
312ALA	11/6/2000 12:15	-0.00688	-0.05	0.06
312ALA	12/4/2000 12:20	-0.00198	0.2	0.06
312ALA	1/3/2001 12:50	-2.7E-05	-0.05	0.06
312ALA	1/31/2001 12:59	-0.00028	-0.05	0.0165
312ALA	3/1/2001 12:39	-0.00015	0.4	0.05
312ALA	4/17/2001 11:00	-0.00022	0.8	0.05
312ALA	1/29/2007 12:26	0.000195	0.39	
312ALA	2/26/2007 12:36	0.000818	0.27	
312ALA	3/27/2007 12:33	0.000429	0.25	
312ALA	4/24/2007 13:12	0.001587	0.18	
312ALA	5/29/2007 12:00	0.000426	0.18	
312ALA	6/25/2007 11:50	0.000197	0.12	
312ALA	7/17/2007 12:32	0.000152	0.078	
312ALA	8/29/2007 12:12	-0.00016	0.071	
312ALA	9/25/2007 12:13	-0.00012	0.043	
312ALA	10/31/2007 12:01		0.12	
312BCD	5/3/2000 16:10	0.094435	3.1	0.22
312BCD	6/7/2000 8:08			
312BCD	6/7/2000 8:08			
312BCD	6/7/2000 8:08	0.020102	1.9	0.83
312BCD	6/26/2000 13:30	0.185941	1.9	0.11
312BCD	6/27/2000 2:40			
312BCD	8/1/2000 3:15			
312BCD	8/1/2000 12:50	0.07194	-0.00787	0.1419
312BCD	9/6/2000 3:55			
312BCD	9/6/2000 8:15	0.021243	1.510112	0.1221
312BCD	10/5/2000 8:55	0.011784	6.022469	0.28677
312BCD	11/8/2000 9:30	-0.00599	5.5	0.51
312BCD	12/7/2000 10:00	-0.0255	12.4	0.22
312BCD	1/4/2001 8:40	0.003555	7.7	0.18
312BCD	1/29/2001 8:45	0.002262	2.9	0.3696
312BCD	2/28/2001 9:10	0.001949	2.7	0.2871
312BCD	1/30/2007 13:07	0.016	8.6	
312BCD	2/27/2007 13:32	0.042	1.8	
312BCD	3/28/2007 12:37	0.004	10	
312BCD	4/25/2007 12:40	0.176	9.4	
312BCD	5/30/2007 12:19	0.012	0.22	
312BCD	6/26/2007 12:01	0.051	0.7	
312BCD	8/28/2007 14:45	0.016	9.2	
312BCD	9/25/2007 13:49	0.044264	1.4	
312BCD	11/8/2007 14:47			
312BCF	1/12/2000 9:00			
312BCF	2/3/2000 9:15			
312BCF	2/17/2000 10:00			
312BCF	3/2/2000 10:25		4.561796	0.6072
312BCF	4/12/2000 10:35	1.198722	45.4	0.76
312BCF	5/3/2000 9:16	0.00525	22.8	0.71
312BCF	6/7/2000 8:51			

312BCF	6/7/2000 8:51	0.005449	15.4	0.43
312BCF	6/7/2000 8:51			
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312BCF	9/7/2000 3:45			
312BCF	11/8/2000 10:20	0.038873	16	0.6
312BCF	12/7/2000 10:40	-0.00181	1.4	0.18
312BCF	8/29/2007 13:31	0.003992	24	
312BCF	11/8/2007 14:15			
312BCG	1/12/2000 11:15			
312BCG	2/17/2000 12:15			
312BCG	3/2/2000 13:20			
312BCG	4/17/2000 12:39		0.4	0.51
312BCG	6/7/2000 13:30			
312BCG	10/6/2000 12:00			
312BCG	11/8/2000 10:47			
312BCG	12/7/2000 13:30			
312BCU	1/11/2000 14:00	0.014909	0.988764	0.132
312BCU	2/15/2000 14:15	0.003239		
312BCU	2/15/2000 14:15		4.719099	0.9141
312BCU	2/15/2000 14:15			
312BCU	2/29/2000 15:30		2.244943	1.2606
312BCU	3/2/2000 9:15			
312BCU	4/12/2000 10:16	-0.00248	5.9	0.42
312BCU	5/3/2000 8:41	0.005453	9.8	0.61
312BCU	6/7/2000 8:26			
312BCU	6/7/2000 8:26			
312BCU	6/7/2000 8:26	0.029349	9.6	0.38
312BCU	6/29/2000 12:05	-0.01083	21.6	0.69
312BCU	6/30/2000 3:10			
312BCU	8/1/2000 5:35			
312BCU	8/1/2000 12:35	0.048458	5.999997	0.27192
312BCU	9/6/2000 8:45	0.003279	5.235953	0.5082
312BCU	9/8/2000 6:30			
312BCU	10/5/2000 9:20	0.002521	8.606738	0.3828
312BCU	11/8/2000 9:55	0.014209	6.8	0.5
312BCU	12/7/2000 10:15	-0.00388	13.3	0.34
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312BCU	2/28/2001 9:30	0.000346	1.6	0.4554
312BCU	1/30/2007 12:13	0.014	9.1	
312BCU	2/27/2007 12:53	0.007	0.32	
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312BCU	4/25/2007 11:48	0.006	15	
312BCU	5/30/2007 11:51	0.073	33	
312BCU	6/26/2007 11:28	0.357	32	
312BCU	7/16/2007 15:02	0.003777	11	
312BCU	8/28/2007 15:22	0.016	10	
312BCU	9/25/2007 14:21	0.044264	28	
312BCU	11/8/2007 14:32			
312BRE	1/12/2000 10:00		-0.01573	0.0858
312BRE	2/3/2000 10:20			
312BRE	2/3/2000 10:20		-0.00787	0.1023
312BRE	2/3/2000 10:20			
312BRE	2/17/2000 11:30		-0.00787	0.1122
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312BRE	6/29/2000 14:30		-0.05	0.11
312BRE	6/30/2000 4:40			
312BRE	8/2/2000 5:10			
312BRE	8/2/2000 10:05		-0.01573	0.1122
312BRE	9/6/2000 11:20			
312BRE	9/6/2000 11:20		-0.01573	0.1155
312BRE	9/6/2000 11:21			
312BRE	9/7/2000 5:35			
312BRE	10/5/2000 12:15		-0.01573	0.1485

312BRE	11/8/2000 12:00		
312BRE	12/7/2000 13:00	-0.05	0.09
312BRE	1/4/2001 11:20	-0.005	0.11
312BRE	1/29/2001 12:11	-0.05	0.033
312BRE	2/28/2001 12:55	-0.05	0.0132
312BSR	5/31/2007 11:05	96	
312BSR	6/27/2007 10:24	63	
312BSR	7/18/2007 10:25	78	
312BSR	8/30/2007 10:42	82	
312BSR	11/8/2007 10:13		
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312CAT	2/17/2000 10:40		
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312CAT	12/7/2000 11:30		
312CAV	1/11/2000 12:00		
312CAV	1/11/2000 12:00		
312CAV	1/11/2000 12:00	-0.00787	-0.00495
312CAV	2/1/2000 11:30		
312CAV	2/1/2000 11:30	0.14382	-0.00495
312CAV	2/1/2000 11:30		
312CAV	2/1/2000 11:45	0.060674	-0.00495
312CAV	2/15/2000 11:15		
312CAV	2/15/2000 11:15	-0.07865	0.01023
312CAV	2/15/2000 11:15		
312CAV	2/15/2000 11:30	0.078652	0.01023
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312CAV	2/29/2000 11:00	0.148315	-0.00495
312CAV	6/6/2000 10:54	-0.05	-0.005
312CAV	6/29/2000 5:20		
312CAV	6/29/2000 9:10	-0.05	-0.005
312CAV	8/1/2000 9:35	-0.01573	-0.00495
312CAV	9/7/2000 11:45	0.044944	-0.00495
312CAV	9/8/2000 4:40		
312CAV	10/5/2000 15:00	0.049438	-0.00495
312CAV	11/6/2000 9:45	-0.05	-0.001
312CAV	12/4/2000 11:00	-0.05	-0.005
312CAV	1/3/2001 11:20	0.1	-0.005
312CAV	1/31/2001 10:30	0.1	-0.00165
312CAV	3/1/2001 10:14	-0.05	0.32
312CAV	4/13/2001 14:00	-0.05	0.08
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312CCC	2/1/2000 13:00		
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312CCC	2/15/2000 12:30		
312CCC	2/15/2000 12:30	-0.03933	-0.00495
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312CCC	2/29/2000 12:45	0.157303	0.01716
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312CCC	6/6/2000 11:56	-0.05	0.01
312CCC	6/29/2000 4:20		
312CCC	6/29/2000 10:20	-0.05	0.04
312CCC	11/6/2000 11:00	-0.05	-0.001
312CCC	12/4/2000 11:45	-0.05	-0.005
312CCC	1/3/2001 12:00	-0.05	-0.005
312CCC	1/31/2001 11:45	-0.05	-0.00165
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312CCC	4/13/2001 12:00	-0.05	0.04
312CUL	1/11/2000 11:30	-0.00787	-0.00495
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312CUL	2/15/2000 11:00		
312CUL	5/1/2000 9:46	-0.05	0.04
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312CUT	2/3/2000 9:20		

312CUT	2/17/2000 10:15		0.292135	0.01023
312CUT	3/2/2000 11:00		0.539326	0.0363
312CUT	4/12/2000 10:45		-0.05	0.01
312CUT	5/3/2000 9:35		-0.05	0.01
312CUT	6/7/2000 9:33			
312CUT	6/7/2000 9:33			
312CUT	6/7/2000 9:33		-0.05	0.01
312CUT	11/8/2000 10:40			
312CUT	12/7/2000 11:00			
312CUT	1/29/2001 10:26		-0.05	0.0264
312CUT	2/28/2001 10:30		0.3	0.0132
312CUT	4/10/2001 13:00		-0.05	-0.005
312CUY	1/11/2000 13:15			
312CUY	2/1/2000 13:45			
312CUY	2/1/2000 13:45		-0.01573	-0.00495
312CUY	2/1/2000 13:45			
312CUY	2/15/2000 13:00			
312CUY	2/15/2000 13:00		1.011236	0.02112
312CUY	2/15/2000 13:00			
312CUY	2/29/2000 13:30		0.83146	0.0528
312CUY	4/13/2000 11:50		-0.05	-0.005
312CUY	6/6/2000 12:40		-0.05	-0.005
312CUY	6/29/2000 3:45			
312CUY	6/29/2000 11:00		-0.05	-0.005
312CUY	8/1/2000 11:15		-0.00787	-0.00495
312CUY	8/2/2000 3:25			
312CUY	9/7/2000 9:47		-0.00787	-0.00495
312CUY	9/8/2000 5:50			
312CUY	10/5/2000 13:40		-0.00787	-0.00495
312CUY	11/6/2000 11:40		-0.05	-0.001
312CUY	12/4/2000 12:00		-0.05	-0.005
312CUY	1/31/2001 12:34		-0.05	-0.00165
312CUY	3/1/2001 12:12		0.5	1
312GVS	1/31/2007 12:16		68	
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312GVS	3/29/2007 13:39		66	
312GVS	4/26/2007 12:36		58	
312GVS	5/31/2007 13:19		66	
312GVS	6/27/2007 13:40		39	
312GVS	7/18/2007 13:15		32	
312GVS	8/30/2007 12:31		65	
312GVS	9/26/2007 12:15		63	
312GVS	11/8/2007 12:58			
312GVT	1/31/2007 12:40		16	
312GVT	2/28/2007 12:52		23	
312GVT	3/29/2007 13:57		34	
312GVT	4/26/2007 12:45		27	
312GVT	5/31/2007 13:36		38	
312GVT	6/27/2007 14:00		61	
312GVT	7/18/2007 13:37		27	
312GVT	8/30/2007 12:50		55	
312GVT	9/26/2007 12:33		24	
312GVT	11/8/2007 13:16			
312HUA	2/15/2000 14:50			
312HUA	2/15/2000 14:50		1.710112	0.6831
312HUA	2/15/2000 14:50			
312HUA	4/13/2000 13:14		-0.05	0.0429
312HUA	5/3/2000 7:42		-0.05	0.13
312MSD	1/12/2000 12:30		0.085393	2.5674
312MSD	2/3/2000 15:45	0.100709	19.55055	43.23
312MSD	2/3/2000 15:45			
312MSD	2/17/2000 15:30		3.66292	2.3001
312MSD	3/2/2000 14:14	0.088966	50.11234	93.72
312MSD	3/2/2000 14:14		50.11234	93.72
312MSD	4/12/2000 17:08	0.081446	7.9	0.85
312MSD	6/7/2000 14:25		10.6	4.87
312MSD	6/26/2000 13:35	0.021778	4.4	0.22
312MSD	6/27/2000 2:50			
312MSD	8/1/2000 3:30			

312MSD	8/1/2000 13:00	0.690552	16.40449	2.3562
312MSD	8/1/2000 13:15		16.3146	2.2737
312MSD	9/6/2000 4:05			
312MSD	9/6/2000 15:20	0.237488	11.50561	7.788
312MSD	10/6/2000 14:40	1.917467	27.6	4.57
312MSD	11/8/2000 15:00	0.448805	11.8	2.42
312MSD	11/8/2000 15:15		11.8	2.38
312MSD	12/7/2000 13:45	0.291639	5.1	0.51
312MSD	12/7/2000 14:15		5.1	0.52
312MSD	1/4/2001 13:15	0.051322	16.2	23.7
312MSD	1/4/2001 13:25		16.2	23
312MSD	1/29/2001 14:00	0.025305	7.5	0.5676
312MSD	1/29/2001 14:15		7.4	0.5742
312MSD	1/30/2007 13:20	0.002	3.5	
312MSD	2/27/2007 14:26	0.008	4.6	
312MSD	3/28/2007 13:33	0.071	29	
312MSD	4/25/2007 12:21	0.787	22	
312MSD	5/30/2007 12:50	0.245	13	
312MSD	6/26/2007 12:50	1.11	20	
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312MSD	8/28/2007 14:21	4.536	53	
312MSD	9/25/2007 13:27	0.064	15	
312MSD	11/8/2007 15:07			
312MSS	2/27/2007 14:14	0.918	46	
312MSS	3/28/2007 13:18	0.002	6.6	
312MSS	4/25/2007 12:09	0.003	7.1	
312MSS	5/30/2007 12:42	0.339	11	
312MSS	6/26/2007 12:25	0.018	7.1	
312MSS	7/16/2007 14:16	0.252218	67	
312MSS	8/28/2007 14:13	1.073	8.2	
312MSS	9/25/2007 13:18	0.039866	-0.009	
312MSS	11/8/2007 15:00			
312NIP	1/11/2000 14:30		2.292134	0.0561
312NIP	1/11/2000 14:40		2.179774	0.0627
312NIP	2/1/2000 14:50			
312NIP	2/1/2000 14:50		1.617977	0.1353
312NIP	2/1/2000 14:50			
312NIP	2/15/2000 14:00			
312NIP	2/15/2000 14:00		4.382021	0.6501
312NIP	2/15/2000 14:00			
312NIP	2/29/2000 15:00		2.026965	0.3465
312NIP	4/10/2000 15:30		1.2	0.0462
312NIP	5/1/2000 11:51		1.2	0.11
312NIP	6/6/2000 13:29		0.5	0.14
312NIP	6/29/2000 2:50			
312NIP	6/29/2000 11:50		0.3	0.21
312NIP	8/1/2000 5:00			
312NIP	8/1/2000 13:25		0.292135	0.1188
312NIP	9/6/2000 3:40			
312NIP	9/7/2000 13:05			
312NIP	9/7/2000 13:05		0.042697	0.0561
312NIP	9/7/2000 13:05		0.042697	0.0561
312NIP	10/6/2000 10:00		-0.05	0.08
312NIP	11/6/2000 12:45		0.8	0.12
312NIP	12/4/2000 12:40		0.5	0.13
312NIP	1/3/2001 13:15		0.4	0.08
312NIP	1/31/2001 13:20		1.2	0.0759
312NIP	3/1/2001 12:59		1.1	0.28
312NIP	1/30/2007 14:13		2.9	
312NIP	2/26/2007 13:05		1.5	
312NIP	3/28/2007 14:10		1.5	
312NIP	4/25/2007 13:16		1	
312NIP	5/30/2007 13:21		-0.009	
312NIT	4/10/2000 15:50		5.3	0.0924
312NIT	5/1/2000 12:11		6.2	0.31
312NIT	6/6/2000 13:48		5.2	0.24
312NIT	6/29/2000 15:50		3.9	0.33
312NIT	6/30/2000 2:50			
312NIT	8/1/2000 4:50			

312NIT	8/1/2000 13:40		5.011234	0.3597
312NIT	9/6/2000 3:20			
312NIT	9/7/2000 13:35			
312NIT	9/7/2000 13:35		2.808988	0.3366
312NIT	9/7/2000 13:35		2.808988	0.3366
312NIT	10/6/2000 10:30			
312NIT	10/6/2000 10:30			
312NIT	10/6/2000 10:30		4.8	0.38
312NIT	11/6/2000 13:00			
312NIT	12/4/2000 13:00		5.3	0.36
312NIT	1/31/2001 13:36		5.2	0.165
312NIT	3/1/2001 13:44		6.3	0.48
312NIT	1/30/2007 14:45		6.4	
312NIT	1/30/2007 14:55		6.4	
312NIT	2/26/2007 14:25		3.2	
312NIT	2/26/2007 14:35		3.2	
312NIT	3/28/2007 14:41		2.3	
312NIT	3/28/2007 14:51		2.3	
312NIT	4/25/2007 13:42		1	
312NIT	4/25/2007 13:52		0.2	
312OFC	1/12/2000 14:15		28.31459	0.0693
312OFC	2/3/2000 14:50	0.169942		
312OFC	2/3/2000 14:50		54.83144	0.1254
312OFC	2/3/2000 14:50			
312OFC	2/17/2000 14:35		26.51684	0.32967
312OFC	3/2/2000 16:25		24.94381	0.1254
312OFC	4/10/2000 16:10	2.117121	70.2	0.3432
312OFC	5/1/2000 12:31	0.049412	39.5	0.63
312OFC	6/6/2000 15:24	1.396424	36.4	0.87
312OFC	6/26/2000 16:25	0.048976	23.8	0.57
312OFC	6/27/2000 4:50			
312OFC	8/2/2000 13:50	0.069879	28.08988	0.22836
312OFC	8/3/2000 5:15			
312OFC	9/6/2000 5:20			
312OFC	9/7/2000 14:10	0.164612		
312OFC	9/7/2000 14:10	0.164612	30.56178	0.3762
312OFC	10/6/2000 11:15	-0.00034	46.8	0.28
312OFC	11/6/2000 14:45	-0.00137	43.8	0.25
312OFC	12/4/2000 13:45	0.055308	33.2	1
312OFC	1/3/2001 14:15	0.038554	38.9	0.73
312OFC	1/31/2001 14:25	0.019299	34.5	0.1914
312OFC	3/1/2001 14:45	0.001287	34	0.35
312OFC	5/31/2007 10:15	0.006	23	
312OFC	6/27/2007 9:40	0.001	43	
312OFC	7/18/2007 9:34	0.001076	45	
312OFC	8/30/2007 10:05	0.006	38	
312OFC	9/26/2007 9:43	0.001366	31	
312OFC	11/8/2007 9:36			
312OFL	1/12/2000 14:05			
312OFL	1/12/2000 14:05		28.31459	0.0693
312OFL	2/3/2000 15:00			
312OFL	2/3/2000 15:00	0.003056	31.01122	0.0792
312OFL	2/3/2000 15:00			
312OFL	2/17/2000 14:50		37.07864	0.6303
312OFL	3/2/2000 16:05		35.05616	0.4125
312OFL	4/10/2000 16:20	0.004143	37.1	0.0825
312OFL	5/1/2000 12:47	0.013368	36.3	0.24
312OFL	6/6/2000 15:58	-0.00231	30.3	0.28
312OFL	6/26/2000 16:45	-0.00197	28.8	0.2
312OFL	6/27/2000 5:20			
312OFL	8/2/2000 14:10	0.000888	31.01122	0.20625
312OFL	9/6/2000 5:45			
312OFL	9/7/2000 14:40		28.53931	0.17589
312OFL	10/6/2000 11:55	-0.00044	31.5	0.25
312OFL	11/6/2000 15:00	0.007072	28.4	0.31
312OFL	12/4/2000 14:15	-0.00303	32.7	0.17
312OFL	1/3/2001 14:45	0.00124	28.7	0.02
312OFL	1/31/2001 15:24	0.000231	28	0.1188
312OFL	3/1/2001 15:10	0.000114	30	0.43

312OFL	1/31/2007 9:13	0	31	
312OFL	2/28/2007 10:06	0.004	22	
312OFL	3/29/2007 9:44	0.003	32	
312OFL	4/26/2007 10:14	0.007	28	
312OFL	5/31/2007 9:40	0.001	32	
312OFL	6/27/2007 9:11	0.001	29	
312OFL	7/18/2007 9:04	0.001078	30	
312OFL	8/30/2007 9:44	0.001	27	
312OFL	9/26/2007 9:13	0.002164	29	
312OFL	11/8/2007 9:17			
312OFL1b	9/7/2000 14:51			
312OFL1b	9/8/2000 7:30			
312OFL1b	9/8/2000 7:45			
312OFL1m	9/7/2000 14:49			
312OFL1m	9/8/2000 7:29			
312OFL1m	9/8/2000 7:44			
312OFL1t	9/7/2000 14:48			
312OFL1t	9/8/2000 7:28			
312OFL1t	9/8/2000 7:43			
312OFL2b	9/7/2000 15:03			
312OFL2m	9/7/2000 15:01			
312OFL2t	9/7/2000 15:00			
312OFN	2/3/2000 15:30			
312OFN	2/3/2000 15:30	0.004924	33.48313	~0.1452
312OFN	2/3/2000 15:30			
312OFN	2/17/2000 15:00		48.76402	0.24189
312OFN	3/2/2000 16:40			
312OFN	3/2/2000 16:45		48.08987	0.19602
312OFN	4/10/2000 16:30		45.1	0.0495
312OFN	4/10/2000 16:45	-0.00058	45.1	0.0462
312OFN	5/1/2000 13:05	0.002897	36.5	0.14
312OFN	6/6/2000 14:50	0.006483	27.2	0.08
312OFN	6/6/2000 15:15		27.2	0.08
312OFN	6/26/2000 16:15	-0.00112	31.2	0.17
312OFN	6/26/2000 16:20		29.3	0.16
312OFN	6/27/2000 4:40			
312OFN	8/2/2000 13:35	0.000653	34.83145	0.1353
312OFN	8/2/2000 13:40		34.83145	0.1353
312OFN	8/3/2000 5:05			
312OFN	9/6/2000 5:10			
312OFN	9/7/2000 14:00			
312OFN	9/7/2000 14:00	0.003807	30.33707	0.1386
312OFN	9/7/2000 14:05	0.003807	30.56178	0.1419
312OFN	9/7/2000 14:05		30.56178	
312OFN	10/6/2000 10:45		30.2	0.16
312OFN	10/6/2000 11:00	-0.00031	30	0.15
312OFN	11/6/2000 14:15		32.9	0.16
312OFN	11/6/2000 14:30	-0.00336	32.8	0.16
312OFN	12/4/2000 13:15		26.5	0.25
312OFN	12/4/2000 13:30	-0.0018	26.5	0.26
312OFN	1/3/2001 13:45		24.4	0.12
312OFN	1/3/2001 13:50	0.000532	27	0.12
312OFN	1/31/2001 14:00		27.1	0.066
312OFN	1/31/2001 14:15	-9.9E-05	27.1	0.0726
312OFN	3/1/2001 14:19		40	0.2
312OFN	3/1/2001 14:19			
312OFN	3/1/2001 14:38	0.000189	39	0.19
312OFN	5/31/2007 10:43	0.001	54	
312OFN	6/27/2007 9:58	0.002	41	
312OFN	7/18/2007 10:03	0.001144	40	
312OFN	8/30/2007 10:22	0.001	46	
312OFN	9/26/2007 9:59	0.000505	40	
312OFN	11/8/2007 9:53			
312OLA	1/12/2000 12:15		12.65168	0.3267
312OLA	2/3/2000 12:15			
312OLA	2/3/2000 12:15	0.079047	55.50559	1.9899
312OLA	2/3/2000 12:15			
312OLA	2/17/2000 12:45		5.707863	0.3729
312OLA	3/2/2000 14:05		1.040449	0.3894

312OLA	4/12/2000 14:44	0.004057	16.8	0.3
312OLA	5/3/2000 14:08	0.056023	23.9	0.41
312OLA	5/3/2000 14:14		23.9	0.42
312OLA	6/7/2000 14:40		19.8	0.56
312OLA	6/7/2000 14:55		14.8	0.5
312OLA	10/6/2000 14:45			
312OLA	11/8/2000 13:00			
312OLA	12/7/2000 14:40			
312OLA	1/29/2001 13:49	0.001344	11.8	0.2607
312OLA	2/28/2001 13:45	-5.2E-05	0.3	0.0594
312ORB	1/12/2000 12:00		3.19101	0.363
312ORB	2/3/2000 12:00	0.001667	4.539324	0.6237
312ORB	2/3/2000 12:00			
312ORB	2/17/2000 12:30		1.483145	0.66
312ORB	3/2/2000 13:50		4.831459	0.8349
312ORB	4/12/2000 14:29		0.9	0.14
312ORB	5/3/2000 13:58		2.9	0.24
312ORB	6/7/2000 15:00		2.7	0.83
312ORB	6/26/2000 14:30		1.2	1.24
312ORB	6/27/2000 3:10			
312ORB	8/1/2000 3:50			
312ORB	8/2/2000 12:20		-0.01573	0.9768
312ORB	10/6/2000 14:50			
312ORB	11/8/2000 13:10		-0.05	0.52
312ORB	12/7/2000 14:35		8.4	0.34
312ORB	1/4/2001 12:50		11.1	0.88
312ORB	1/29/2001 13:35		6.5	0.2706
312ORB	2/28/2001 13:55		8.5	0.0264
312ORB	1/31/2007 13:06		24	
312ORB	1/31/2007 13:16		24	
312ORB	2/28/2007 13:18		3	
312ORB	2/28/2007 13:28		2.7	
312ORB	3/29/2007 14:24		16	
312ORB	3/29/2007 14:34		16	
312ORB	4/26/2007 13:16		47	
312ORB	4/26/2007 13:26		47	
312ORB	5/31/2007 14:01		27	
312ORB	5/31/2007 14:11		27	
312ORB	6/27/2007 14:33		28	
312ORB	6/27/2007 14:43		28	
312ORB	7/18/2007 14:00		28	
312ORB	7/18/2007 14:10		28	
312ORB	8/30/2007 13:18		27	
312ORB	9/26/2007 12:56		23	
312ORB	9/26/2007 13:06		22	
312ORB	11/8/2007 13:41			
312ORC	1/12/2000 13:00		17.7528	0.25971
312ORC	2/3/2000 13:35			
312ORC	2/3/2000 13:35	0.00116	26.0674	0.1518
312ORC	2/3/2000 13:35			
312ORC	2/17/2000 13:30		31.01122	0.5577
312ORC	3/2/2000 15:05		16.94381	0.66
312ORC	4/12/2000 15:58	0.005036	30.4	0.49
312ORC	5/3/2000 14:45	0.004883	20.5	0.53
312ORC	6/7/2000 15:20		34.4	0.54
312ORC	6/26/2000 15:10	0.034085	25.5	0.82
312ORC	6/27/2000 3:40			
312ORC	8/2/2000 12:50	0.003042	28.76403	0.23364
312ORC	8/3/2000 4:30			
312ORC	9/6/2000 12:57			
312ORC	9/6/2000 12:57			
312ORC	9/6/2000 12:57	0.00252	32.35954	0.27951
312ORC	9/7/2000 6:50			
312ORC	10/6/2000 13:10	-0.00037	21	0.67
312ORC	11/8/2000 13:45	0.002979	29.8	0.46
312ORC	12/7/2000 15:05	0.003366	24.8	0.3
312ORC	1/4/2001 14:00	0.000508	27.5	0.25
312ORC	1/29/2001 14:37	0.000393	31.2	0.1221
312ORC	2/28/2001 14:30	0.000215	17.7	0.0198

312ORC	4/6/2001 13:00	0.001131	24.5	0.82
312ORC	1/31/2007 11:12	0	31	
312ORC	2/28/2007 11:35	0.002	24	
312ORC	3/29/2007 12:07	0.003	32	
312ORC	4/26/2007 11:46	0.006	29	
312ORC	5/31/2007 12:22	0.047	30	
312ORC	6/27/2007 11:01	0.002	29	
312ORC	7/18/2007 11:41	0.001076	28	
312ORC	8/30/2007 11:52	0.006	33	
312ORC	9/26/2007 10:54	0.001366	31	
312ORC	11/8/2007 12:01			
312ORI	1/12/2000 12:45		56.85391	0.23958
312ORI	2/3/2000 13:15			
312ORI	2/3/2000 13:15	0.001992	56.17975	0.23232
312ORI	2/3/2000 13:15			
312ORI	2/17/2000 13:15		28.08988	0.7029
312ORI	3/2/2000 14:50		9.82022	0.429
312ORI	4/12/2000 15:15	0.06971	40.7	0.48
312ORI	5/3/2000 14:25	0.00987	22.7	0.68
312ORI	6/7/2000 15:10		36.3	0.62
312ORI	6/26/2000 14:55	0.312971	42.3	1.11
312ORI	6/27/2000 3:25			
312ORI	8/1/2000 4:00			
312ORI	8/2/2000 12:35	0.000861	41.79773	0.19536
312ORI	9/6/2000 4:35			
312ORI	9/6/2000 12:35	0.173037		
312ORI	9/6/2000 12:35	0.173037	40.2247	0.3696
312ORI	10/6/2000 14:25	-0.00027	50.2	0.25
312ORI	11/8/2000 13:30	0.035263	63.8	0.37
312ORI	12/7/2000 14:50	-0.00105	55.5	0.22
312ORI	1/4/2001 13:40	0.006631	32.4	0.7
312ORI	1/29/2001 14:30	0.029838	39.9	0.2079
312ORI	2/28/2001 14:15	0.000331	19.4	0.0198
312ORI	1/31/2007 11:45	0.001	43	
312ORI	2/28/2007 12:04	0.004	37	
312ORI	3/29/2007 12:45	0.18	45	
312ORI	4/26/2007 12:03	0.003	53	
312ORI	5/31/2007 12:40	0.001	56	
312ORI	6/27/2007 13:13	0.001	69	
312ORI	7/18/2007 12:46	0.001148	58	
312ORI	8/30/2007 12:09		64	
312ORI	9/26/2007 11:54	0.002661	62	
312ORI	11/8/2007 12:45			
312SAL	1/11/2000 12:30			
312SAL	2/1/2000 12:30			
312SAL	2/15/2000 12:00			
312SAL	2/29/2000 11:45		0.121348	2.1879
312SAL	11/6/2000 10:30			
312SAL	12/4/2000 11:30			
312SBC	1/11/2000 13:50			
312SBC	1/17/2000 9:35			
312SBC	2/3/2000 15:40			
312SBC	2/17/2000 9:35		0.224719	0.01485
312SBC	3/2/2000 9:45		0.494382	0.4323
312SBC	5/3/2000 8:55		-0.05	0.03
312SBC	11/8/2000 10:10			
312SBC	12/7/2000 10:20			
312SBC	2/28/2001 9:50		-0.05	0.0132
312SBC	4/10/2001 14:00		0.5	0.27
312SIS	1/12/2000 9:15			
312SIS	2/17/2000 10:25			
312SIS	3/2/2000 10:45		0.224719	0.0429
312SIS	4/12/2000 11:27		-0.05	-0.001
312SIS	5/3/2000 10:00		-0.05	-0.001
312SIS	6/7/2000 9:40			
312SIS	11/8/2000 10:45			
312SIS	12/7/2000 11:15			
312SIS	2/28/2001 11:05		-0.05	0.0132
312SIS	4/6/2001 0:00		-0.05	0.03

312SIV	1/12/2000 10:30		-0.00787	0.03267
312SIV	1/12/2000 10:45		-0.00787	0.0363
312SIV	2/3/2000 9:45			
312SIV	2/3/2000 9:45		-0.00787	~0.0396
312SIV	2/3/2000 9:45			
312SIV	2/3/2000 10:00		-0.00787	0.13
312SIV	2/17/2000 11:00		0.044944	0.01023
312SIV	2/17/2000 11:15		0.053933	0.01023
312SIV	3/2/2000 12:15		0.074157	0.01023
312SIV	3/2/2000 12:30		0.078652	0.01023
312SIV	4/12/2000 12:15		-0.05	-0.001
312SIV	5/3/2000 11:35		-0.05	-0.001
312SIV	6/7/2000 11:55			
312SIV	6/7/2000 11:55		-0.05	0.02
312SIV	6/7/2000 11:55			
312SIV	6/29/2000 14:05		-0.05	0.02
312SIV	6/30/2000 4:20			
312SIV	8/2/2000 4:45			
312SIV	8/2/2000 10:40		-0.00787	0.02343
312SIV	9/6/2000 10:35		-0.00787	0.02871
312SIV	9/7/2000 4:35			
312SIV	10/5/2000 11:20		-0.00787	0.0462
312SIV	11/8/2000 11:30		-0.05	0.02
312SIV	12/7/2000 12:30		-0.05	0.03
312SIV	1/4/2001 10:45		-0.005	0.04
312SIV	1/29/2001 11:39		-0.05	-0.00165
312SIV	2/28/2001 12:34		-0.05	0.0033
312SIV	4/20/2001 18:30		-0.05	0.01
312SMA	1/12/2000 13:15		18.51685	0.18513
312SMA	2/3/2000 13:45			
312SMA	2/3/2000 13:45	0.007023	23.5955	0.1287
312SMA	2/3/2000 13:45			
312SMA	2/17/2000 13:50		22.38201	0.4587
312SMA	3/2/2000 15:20		12.96629	0.5313
312SMA	4/12/2000 16:23	-0.00313	25.1	0.38
312SMA	5/3/2000 15:05	0.032658	24.6	0.47
312SMA	6/7/2000 15:45		28	0.45
312SMA	6/26/2000 15:30	0.049663	26.7	0.87
312SMA	6/27/2000 4:00			
312SMA	8/2/2000 13:05	0.003287	25.61797	0.21747
312SMA	9/6/2000 13:35	0.004267	32.58426	0.27324
312SMA	9/7/2000 7:10			
312SMA	10/6/2000 13:40	-0.00023	19.1	0.35
312SMA	11/8/2000 14:00	-0.00303	29.5	0.38
312SMA	12/7/2000 15:25	0.00609	20.5	0.2
312SMA	1/4/2001 14:34	0.001474	25.5	0.4
312SMA	1/29/2001 15:00	0.001061	27.8	0.1089
312SMA	2/28/2001 14:55	0.000503	18.5	0.0165
312SMA	4/24/2001 9:00			
312SMA	4/24/2001 9:00	0.001989	18.04494	0.3531
312SMA	4/24/2001 9:00			
312SMA	5/29/2001 9:00			
312SMA	5/29/2001 9:00	0.002679	25.61797	0.27885
312SMA	6/26/2001 9:00			
312SMA	6/26/2001 9:00	0.001727	20.4719	0.3531
312SMA	7/26/2001 9:20	0.007047	24.49437	0.3267
312SMA	7/26/2001 9:20			
312SMA	8/27/2001 9:25	0.001161	23.14606	0.27423
312SMA	8/27/2001 9:25			
312SMA	9/19/2001 8:50	0.001302	18.53932	0.25938
312SMA	9/19/2001 8:50			
312SMA	10/22/2001 9:19			
312SMA	10/22/2001 9:19	0.000869	26.5	0.18
312SMA	10/22/2001 9:19			
312SMA	11/19/2001 9:01			
312SMA	11/19/2001 9:01	0.000995	21.8	0.2
312SMA	11/19/2001 9:01			
312SMA	12/13/2001 9:26			
312SMA	12/13/2001 9:26	0.002662	21.1	0.2

312SMA	12/13/2001 9:26				
312SMA	1/15/2002 8:56				
312SMA	1/15/2002 8:56	0.000717	19.7		0.14
312SMA	1/15/2002 8:56				
312SMA	2/19/2002 8:27	0.0007	19		0.15
312SMA	2/19/2002 8:27				
312SMA	3/12/2002 9:32	0.003124	24.9		1
312SMA	3/12/2002 9:32				
312SMA	4/9/2002 9:21	0.001621	20.4		0.35
312SMA	4/9/2002 9:21				
312SMA	4/9/2002 9:21				
312SMA	5/7/2002 8:49	0.000422	26.8		0.23
312SMA	5/7/2002 8:49				
312SMA	6/6/2002 9:14	0.000682	24.8		0.28
312SMA	6/6/2002 9:14				
312SMA	6/6/2002 9:14				
312SMA	6/26/2002 9:19	0.002379	27.2		0.33
312SMA	6/26/2002 9:19				
312SMA	6/26/2002 9:19				
312SMA	7/29/2002 8:51		26.3		0.23
312SMA	7/29/2002 8:51	0.001524			
312SMA	8/28/2002 8:51		27		0.32
312SMA	8/28/2002 8:51	0.000959			
312SMA	9/25/2002 9:05				
312SMA	9/25/2002 9:05		30.3		0.28
312SMA	9/25/2002 9:05	0.008947			
312SMA	10/23/2002 8:38				
312SMA	10/23/2002 8:38	0.001929	28.2		0.24
312SMA	10/23/2002 8:38				
312SMA	11/21/2002 9:22				
312SMA	11/21/2002 9:22	0.011261	25		0.21
312SMA	11/21/2002 9:22				
312SMA	12/19/2002 8:57				
312SMA	12/19/2002 8:57	0.000604	22.3		0.34
312SMA	12/19/2002 8:57				
312SMA	2/19/2003 8:48	0.001582	16.8		0.21
312SMA	2/19/2003 8:48				
312SMA	3/19/2003 8:48	0.001138	18.3		0.3
312SMA	3/19/2003 8:48				
312SMA	3/3/2004 9:50	0.002797	24.6		0.28
312SMA	3/3/2004 9:50				
312SMA	4/1/2004 12:56	0.008402	26.3		0.4
312SMA	4/1/2004 12:56				
312SMA	5/20/2004 10:39	0.031547	35.2	~0.35	
312SMA	5/20/2004 10:39				
312SMA	6/24/2004 11:47	0.003875	29.6		0.3
312SMA	6/24/2004 11:47				
312SMA	8/2/2004 11:17	0.003925			
312SMA	8/2/2004 11:17		25.3		0.29
312SMA	8/2/2004 11:17				
312SMA	8/30/2004 9:18	0.00145	26.7		0.23
312SMA	8/30/2004 9:18				
312SMA	10/4/2004 10:34		48.7		0.17
312SMA	10/4/2004 10:34	0.007932			
312SMA	10/4/2004 10:34				
312SMA	11/1/2004 9:56				
312SMA	11/1/2004 9:58		38.4		0.2
312SMA	11/1/2004 9:58	0.001609			
312SMA	12/7/2004 11:00		41.4		0.22
312SMA	12/7/2004 11:00				
312SMA	12/7/2004 11:00	0.001232			
312SMA	1/4/2005 13:24		13		0.54
312SMA	1/4/2005 13:24				
312SMA	1/4/2005 13:24	0.001762			
312SMA	2/3/2005 9:21		12.9		0.52
312SMA	2/3/2005 9:21				
312SMA	2/3/2005 9:21	0.001948			
312SMA	3/2/2005 9:42		14		0.3
312SMA	3/2/2005 9:42				

312SMA	3/2/2005 9:42	0.001829		
312SMA	3/29/2005 8:36		17	0.32
312SMA	3/29/2005 8:36			
312SMA	3/29/2005 8:36	0.00267		
312SMA	4/27/2005 10:34		37	0.34
312SMA	4/27/2005 10:34			
312SMA	4/27/2005 10:34	0.008036		
312SMA	5/25/2005 9:10		37	0.33
312SMA	5/25/2005 9:10	0.009397		
312SMA	6/22/2005 9:07		32	0.45
312SMA	6/22/2005 9:07	0.009205		
312SMA	7/27/2005 8:42	0.01401		
312SMA	8/24/2005 9:42			
312SMA	8/24/2005 9:42	0.02894		
312SMA	9/22/2005 9:33			
312SMA	9/22/2005 9:33	0.016246		
312SMA	1/4/2007 9:57		21	
312SMA	1/31/2007 10:43		25	
312SMA	2/28/2007 10:56	0.009205	25	
312SMA	3/29/2007 11:21		25	
312SMA	4/26/2007 11:09		27	
312SMA	5/31/2007 12:03	0.01401	26	
312SMA	6/27/2007 11:15	0.002	26	
312SMA	7/18/2007 11:18	0.003646	28	
312SMA	8/30/2007 11:28	0.002	24	
312SMA	9/26/2007 11:00	0.001388	28	
312SMA	11/8/2007 11:29			
312SMI	1/12/2000 13:45		25.61797	0.1584
312SMI	2/3/2000 14:30			
312SMI	2/3/2000 14:30	0.002336	20.3146	0.21714
312SMI	2/3/2000 14:30			
312SMI	2/17/2000 14:15		23.5955	0.4521
312SMI	3/2/2000 15:45		27.41572	0.363
312SMI	4/12/2000 16:45	-0.00257	42	0.62
312SMI	5/3/2000 15:30	0.009169	51.4	0.39
312SMI	6/7/2000 16:20		24.5	2.95
312SMI	6/26/2000 16:00	-0.00287	38.6	0.23
312SMI	6/27/2000 4:25			
312SMI	8/2/2000 13:30	0.222204	44.9438	0.29106
312SMI	8/3/2000 4:50			
312SMI	9/6/2000 5:00			
312SMI	9/6/2000 15:00		33.70785	0.3498
312SMI	10/6/2000 12:20	-0.00074	33	0.57
312SMI	11/8/2000 14:30	-0.00214	18.4	0.08
312SMI	12/7/2000 15:45	-0.00348	25.8	0.21
312SMI	1/4/2001 15:05	0.001091	24.8	0.36
312SMI	1/29/2001 15:35	0.000611	21.8	0.1452
312SMI	2/28/2001 15:22	0.000416	26.2	0.1089
312SMI	4/17/2001 8:30	0.00103	31.7	0.39
312SMI	3/29/2007 10:19	0.00061	22	